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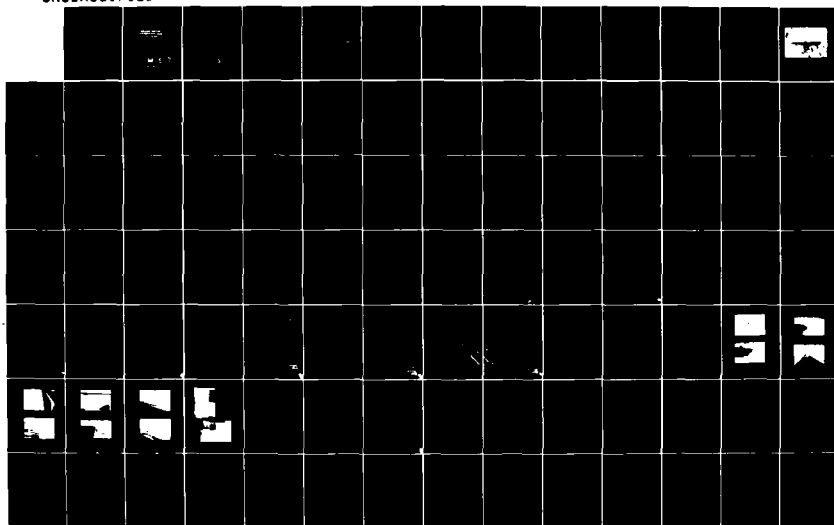
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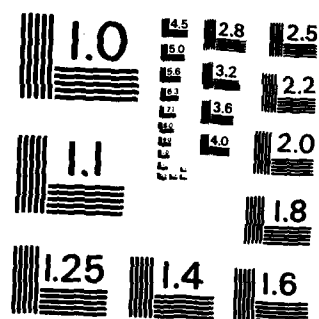
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HOUSATONIC RIVER BASIN

SHELTON, CONNECTICUT

**MEANS BROOK
RESERVOIR DAM
CT 00092**

**PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM**

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**DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.**

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00092	2. GOVT ACCESSION NO. A142859	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Housatonic River Basin Shelton, Conn., Means Brook Reservoir Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE April 1980
		13. NUMBER OF PAGES 85
		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		16a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Housatonic River Basin Shelton, Conn. Means Brook Reservoir Dam		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam at Means Brook Reservoir is concrete, 527 ft. long, 50 ft. high at the center of the dam, has a 100 ft. long spillway, has a top width of 10 ft., and a 2.1 high ft. wall along the top. It was originally built in 1917 with subsequent spillway and top of dam modifications in 1977. The Bridgeport Hydraulic Company presently owns and operates the dam including its waterworks facilities. The impoundment storage at the top of the dam is 373 ac.-ft. and the maximum height of the dam is 50 ft. The test flood for this dam is the PMF.		

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF
NEDED

MAY 6 1977

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford Connecticut 06115

Dear Governor Grasso.

Inclosed is a copy of the Means Brook Keservoir Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, Bridgeport Hydraulic Company, 835 Main Street, Bridgeport, Connecticut 06609.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely,


MAX B. SCHEIDER

Colonel, Corps of Engineers
Division Engineer

Incl
As stated

HOUSATONIC RIVER BASIN

SHELTON, CONNECTICUT

MEANS BROOK RESERVOIR DAM

CT 00092



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PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I - INSPECTION REPORT

Identification No.:	CT 00092
Name of Dam:	Means Brook Reservoir Dam
Town:	Shelton
County and State:	Fairfield County, Connecticut
Stream:	Means Brook
Date of Inspection:	November 16, 1979

BRIEF ASSESSMENT

The dam at Means Brook Reservoir is concrete, 527 feet long, 50 feet high at the center of the dam (from the top of the crest wall to the toe of the downstream embankment), has a 100 foot long spillway, has a top width of 10 feet, and a 2.1 high foot wall along the top. It was originally built in 1917 with subsequent spillway and top of dam modifications in 1977. The Bridgeport Hydraulic Company presently owns and operates the dam including its waterworks facilities.

Based on the visual inspection and past operational performance, the dam is judged to be in FAIR condition. Significant spalling of the concrete and efflorescence was noted on the downstream face of the dam, and the edges of the top of the dam are chipped revealing reinforcement in places.

This dam is classified as INTERMEDIATE in size and a HIGH hazard potential structure in accordance with recommended guidelines established by the Corps of Engineers. The impoundment storage at the top of the dam is 373 ac.-ft. and the maximum height of the dam is 50 feet. Failure of the dam would result in the loss of more than a few lives and excessive damage to 25-30 residential homes.

The test flood for this dam is the Probable Maximum Flood (PMF). The test flood has an inflow equal to 7800 cfs and an outflow discharge of 7800 cfs, with stillwater elevation of 351.5 which will overtop the dam by 1.4 feet. The maximum outflow capacity of the spillway is 4000 cfs which is 51 percent of the test flood.

It is recommended that the following items be studied further: The upstream face of the dam, the spalled concrete on the downstream face and top of the dam, the subsurface leakage beneath the spillway, and the structural stability.

The following remedial measures should be taken; the toe at the downstream face be monitored for leakage, and the development of a downstream warning plan and an annual inspection program.

Recommendations and remedial measures that should be implemented within one year of receipt of this Phase I Inspection Report are further described in Section 7.

JAMES P. PURCELL ASSOCIATES, INC.

Sudhir A. Shah

Sudhir A. Shah, P.E.
Vice-President
Connecticut P.E. No. 8012



This Phase I Inspection Report on MEANS BROOK RESERVOIR DAM has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Richard J. DiBuono

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

Aramast Mahtesian

ARAMAST MAHTESIAN, CHAIRMAN
Geotechnical Engineering Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar
JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation. However, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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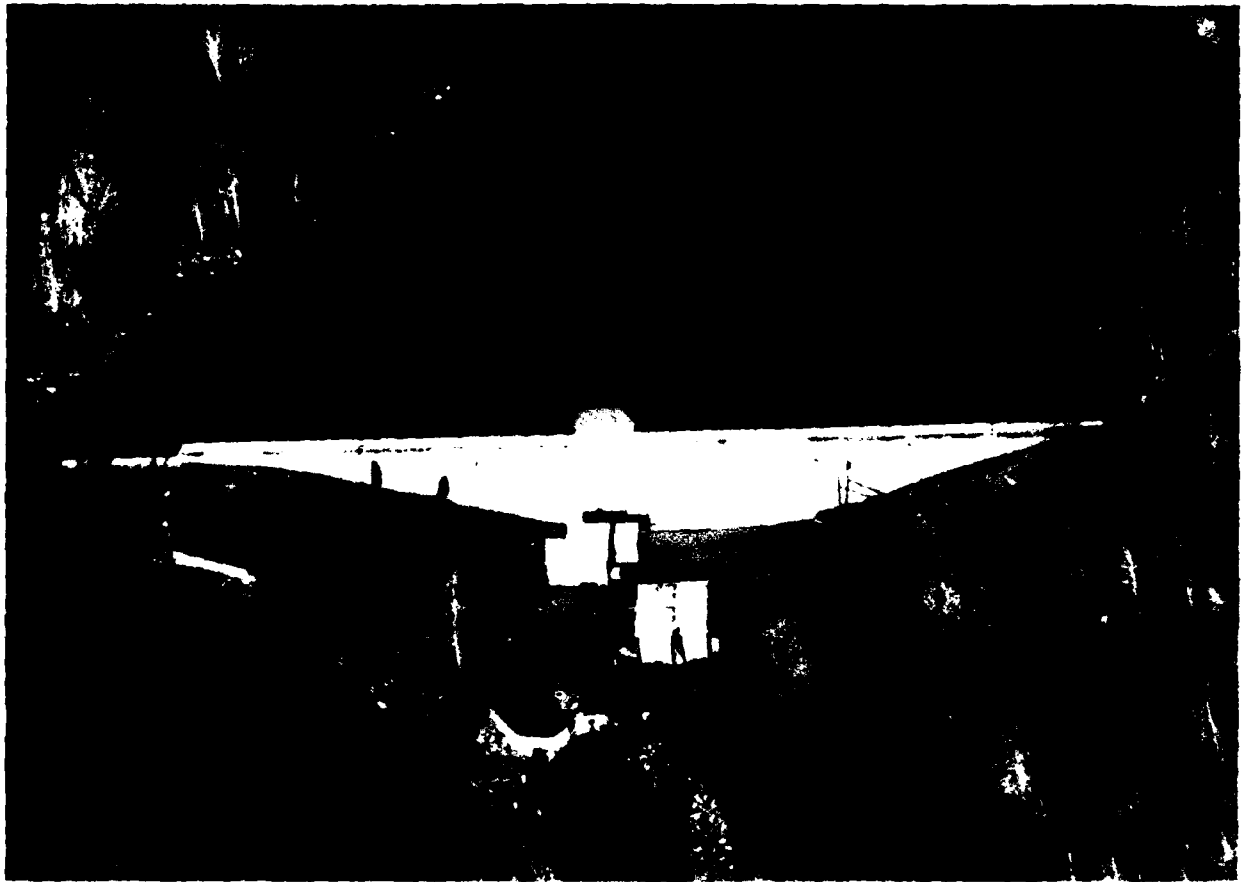
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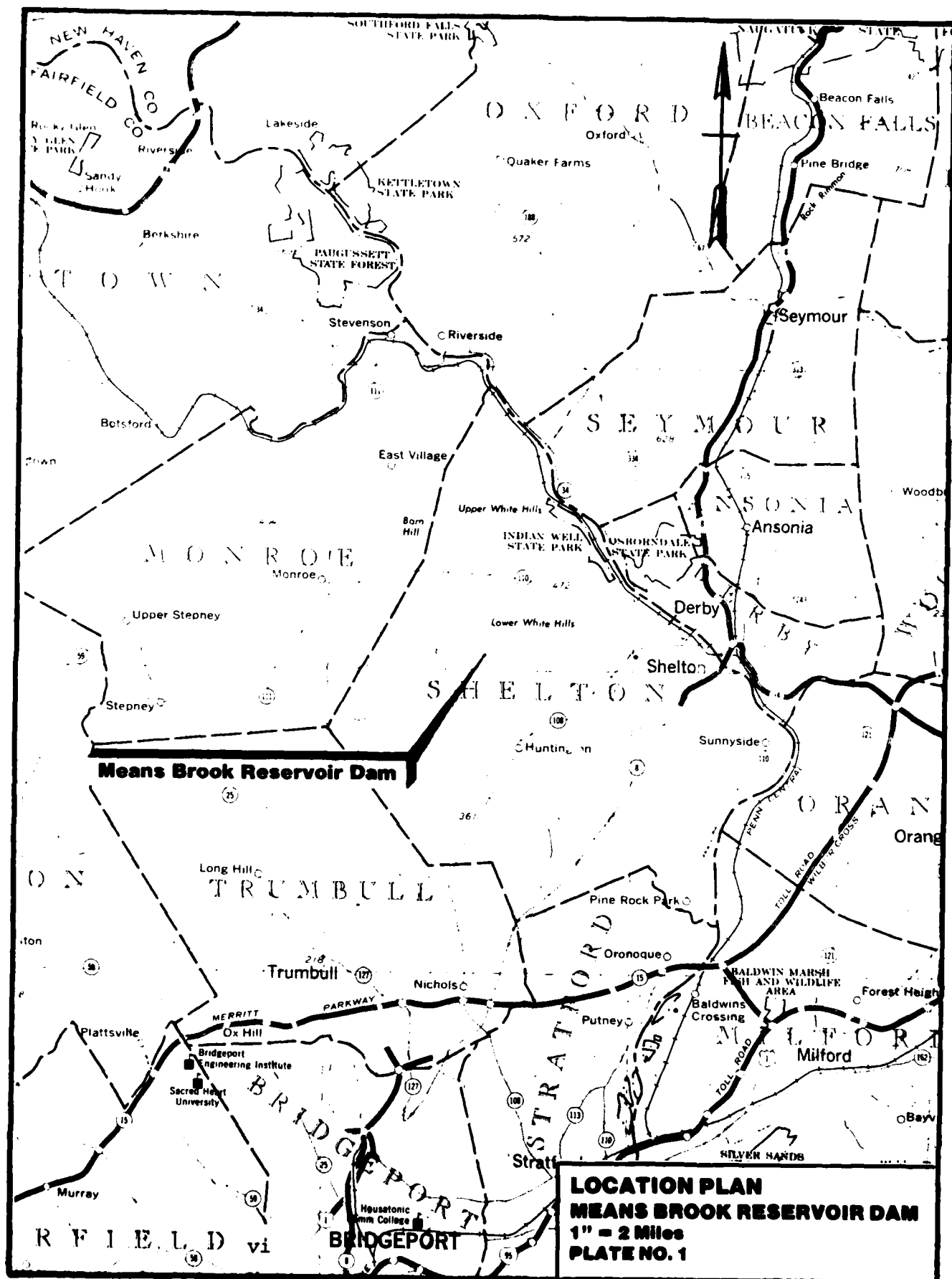
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OVERVIEW PHOTO - MEANS BROOK RESERVOIR DAM



NATIONAL DAM INSPECTION PROGRAM

PHASE I - INSPECTION REPORT

NAME OF DAM: MEANS BROOK RESERVOIR DAM

SECTION 1

PROJECT INFORMATION

1.1 General

- a. **Authority:** Public Law 92-367, August 8, 1972, authorized the Secretary of the Army through the Corps of Engineers to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. James P. Purcell Associates, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed was issued to James P. Purcell Associates, Inc., under a letter from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-89-C-0002 has been assigned by the Corps of Engineers for this work.
- b. **Purpose:**
 - 1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
 - 2. Encourage and prepare the States to initiate quickly, effective dam safety programs for non-Federal dams.
 - 3. To update, verify and complete the National Inventory of Dams.

1.2 Description of the Project

- a. **Location:** Means Brook Reservoir Dam is located in the Town of Shelton in Fairfield County, Connecticut, approximately 1.6 miles north of the village of Huntington along Means Brook (see Plate No. 1). The dam impounds water from Means Brook and is located 11,500 feet above the confluence with Farmill River. The impoundment is situated in a northwest/southeast direction, with the dam at the southeast end. The longitude is 73°-09'-28" and the latitude is 41°-18'-57".

All elevations used in this report are based on the National Geodetic Vertical Datum (NGVD).

- b. **Description of Dam and Appurtenances:** Means Brook Reservoir Dam is a concrete structure with abutments and foundation keyed into rock. The length at the top of the dam is 527 feet and maximum depth to the bottom of the cutoff is 59.5 feet. The spillway is a concrete ogee weir and is located at, and is keyed into rock at the west abutment at the end of the dam. It has a length of 100.0 feet and a width of 6 feet with a crest elevation of 345.0. The width of the original top of the dam is 10.0 feet and is 3 feet above the top of the spillway. A 2.1 foot high concrete wall was added to the dam's crest in 1977. The maximum width at the base of the dam is 35+/- feet. The upstream face of the dam is concrete and is vertical in a cross sectional view. The downstream face of the dam is also concrete and is battered at 0.7H: 1.0V from the toe to a distance of approximately 24.0 feet from the top of the dam. Continuing to elevation 346.5, the face of the dam, in a cross sectional view, is concave with a radius equal to 36 feet.

The upper gate house is a concrete structure located on the top of the dam approximately in the center of the dam. Water can enter the wet well via a 36 inch sluice gate with an invert at elevation 335.4 and a 16 inch sluice gate with an invert at elevation 322.0. Water flows from the upper gate house through the dam to the concrete lower gate house via the following pipes: A 30 inch service main, a 10 inch auxiliary service, and an 8 inch drain. The 10 inch auxiliary service joins the 30 inch service main in the lower gate house and a 36 inch pipe continues downstream to an outfall at Trap Falls Reservoir. Both pipes have gate valves in the lower gate house. The 8 inch drain is controlled by a gate valve in the lower gate house and drains to the blowoff pipe.

The blowoff is a 24 inch pipe with an invert on the upstream face of the dam approximately at elevation 307.0. The pipe extends through the dam to the lower gate house where discharge is controlled by a gate valve. The 24 inch pipe continues downstream, transitions to a 16 inch pipe, and outlets at an endwall 160 feet below the dam. A 12 inch blowoff from the 36 inch service main controlled by a valve in a manhole also discharges at this endwall.

- c. **Size Classification:** The size classification of this dam is INTERMEDIATE as per the criteria set forth in the Recommended Guidelines for Safety Inspection of Dams, by the Corps of Engineers. The impoundment storage at the top of the dam is 373 acre-feet (within the "small" range of 50 to 1000 ac.-ft.) and the maximum height of the dam is 50 feet (within the range of 40 to 100 feet). The size classification is based on the height criteria.
- d. **Hazard Classification:** The hazard classification of this dam is HIGH as per the criteria set forth in the Recommended Guidelines for Safety Inspection of Dams,

by the Corps of Engineers. The failure of the dam would result in more than a few losses of lives and extensive damage to residential areas located downstream. Twenty-five to thirty homes will be inundated by 2 to 5 feet of water.

- e. **Ownership:** The Means Brook Reservoir is presently owned and maintained by the Bridgeport Hydraulic Company, 835 Main Street, Bridgeport, Connecticut 06609.

- f. **Operator:** The person in charge of the day-to-day operation of this dam is:

Mr. Mark L. Johnson
Superintendent of System Operations
Bridgeport Hydraulic Company
835 Main Street
Bridgeport, CT 06609
Tel. (203) 367-6621

- g. **Purpose of Dam:** The Means Brook Reservoir Dam impounds water from Means Brook and is used to supply water to the distribution system of the Bridgeport Hydraulic Company.
- h. **Design and Construction History:** The dam was constructed in 1917. The spillway was rehabilitated and extended 25 feet, a 2.1 foot concrete wall was added along the top of the dam, and the raceway was widened in 1977. Other minor modifications to some of the appurtenant structures also took place. Various changes in the subsurface pipe network below the dam and the addition of the high lift pump house have taken place over the years. The piping through the dam has apparently remained unchanged.
- i. **Normal Operating Procedures:** Water is withdrawn via the 36 inch sluice gate and 30 inch service main, and continues to Trap Falls Reservoir via the 36 inch pipe. All other valves and pipes are normally closed.

1.3 Pertinent Data

- a. **Drainage Area:** The Means Brook Reservoir drainage basin extends approximately 1.5 miles south of Route 110 and 2.3 miles north of Route 110 in the western section of Shelton and eastern section of Monroe. The basin is generally rectangular in shape having a length of 3.8 miles and an average width of 2.1 miles. The total drainage area to the dam is 7.65 square miles (see drainage basin map in Appendix D) including 1.88 square miles draining to a 5 foot high horseshoe shaped aqueduct. This aqueduct diverts water from Hurds Brook to Means Brook in the northwest portion of the watershed. The topography is generally moderate to steep terrain, with elevations ranging from a high of 650

feet to a low of 345 feet at the spillway crest. Stream slopes are flat having an average grade of 1/4 percent. Basin slopes range from 5 to 10 percent. The normal pond area is 18.4 acres which is 0.4 percent of the watershed.

- b. **Discharge at Dam Site:** Daily water usage records are available from the Bridgeport Hydraulic Company. Other than this, there are no specific flood discharge records available for this dam. Listed below are calculated discharge values for the spillway and outlet works (30 inch service main and 24 inch blowoff).

1. **Outlet Works:** A 30 inch service main with an intake invert at elevation 322.0 and a discharge capacity of 113 cfs at elevation 345.0. A 24 inch blowoff with an invert approximately at elevation 307.0 and a discharge capacity of 42 cfs at elevation 345.0.
2. **Maximum Known Discharge at Dam Site:** Calculated to be 2000 cfs in October, 1955 based on a recorded flow of 4 inches over the dam. The spillway was 76.5 feet long and the wall on the top of the dam did not exist at this time.
3. **Spillway Capacity at Top of Dam (Crest Wall):** 4000 cfs at elevation 350.1.
4. **Spillway Capacity at Test Flood Level:** 5800 cfs at elevation 351.5.
5. **Gated Outlet Capacity at Normal Pool Elevation:** 113 cfs (30 inch main) and 42 cfs (24 inch blowoff) at elevation 345.0.
6. **Gated Outlet Capacity at Test Flood Level:** 128 cfs (30 inch main) and 45 cfs (24 inch blowoff) at elevation 351.5.
7. **Gated Outlet Capacity at Top of Dam (Crest Wall) Elevation:** 125 cfs (30 inch main) and 44 cfs (24 inch blowoff) at elevation 350.1.
8. **Total Project Discharge at Top of Dam (Crest Wall) Elevation:** 4170 cfs at elevation 350.1.
9. **Total Project Discharge at Test Flood Elevation:** 7970 cfs at elevation 351.5.

- c. **Elevation (Ft. above N.G.V.D.)**

1. **Stream bed at toe of dam**
305+/- (upstream)
300+/- (downstream)

2. Bottom of cutoff	Approximately 290.6 at lowest point.
3. Maximum tailwater	N/A
4. Recreation pool	N/A
5. Full flood control pool	N/A
6. Spillway crest (Normal pool)	345.0
7. Design surcharge (1977 Original Design)	349.1 w/1' freeboard
8. Top of dam	350.1 (top of wall) 348.0 (top of dam)
9. Test flood level	351.5
d. Reservoir (Length in feet)	
1. Normal pool	1600
2. Flood control pool	N/A
3. Spillway crest pool	1600
4. Top of dam (crest wall)	2500
5. Test flood pool	2500
e. Storage (acre-feet)	
1. Normal pool	268
2. Flood control pool	N/A
3. Spillway crest pool	268
4. Top of dam (crest wall)	373
5. Test flood pool	412

f. Reservoir Surface (acres)

1. Normal pool	18.4
2. Flood control pool	N/A
3. Spillway crest	18.4
4. Test flood pool	26.0
5. Top of dam (crest wall)	24.0

g. Dam

1. Type	Concrete
2. Length	527 feet
3. Height	50 feet (top of wall to downstream toe)
4. Top width	10 feet (top of dam) 1 foot (top of wall)
5. Side slopes	Upstream: vertical Downstream: 0.7H:1.0V and radius of 36'
6. Zoning	Concrete
7. Impervious core	Concrete
8. Cutoff	Concrete keyed into bedrock
9. Grout curtain	N/A

h. Diversion and Regulating Tunnel

N/A

i. Spillway

1. Type	Overflow, ogee crest, uncontrolled weir
---------	--

2.	Length of weir	100 feet
3.	Crest elevation	345.0
4.	Gates	None
5.	U/S Channel	Bedrock
6.	D/S Channel	Bedrock

j. Regulating Outlets

Refer to Paragraph 1.2b - "Description of Dam and Appurtenances" for description of Outlet Works.

1.	Inverts	335.4 — 36 inch main intake 322.0 — 16 inch auxiliary intake 307+/- 24 inch blowoff intake
2.	Size	30 inch service main 10 inch auxiliary service 8 inch drain 24 inch blowoff
3.	Description:	Cast iron pipes
4.	Control mechanisms	Hand operated lift mechanisms in the upper gate house. Gate valves in the lower house.

SECTION 2

ENGINEERING DATA

2.1 Design

Available design data consists of the following documents and plans:

- a. Bridgeport Hydraulic Co., Means Brook Development, Plan and Profile of Dam, Town of Huntington, Connecticut, May, 1915.
- b. Bridgeport Hydraulic Co., Means Brook Development, Plan, Profile and Cross Section of Dam, Town of Huntington, Connecticut, February 1916.
- c. Plans for Revisions to Means Brook Spillway, Designed by Seelye, Stevenson, Value and Knecht, 1977.
- d. Design Report, Revisions to Means Brook Reservoir Spillway for Bridgeport Hydraulic Company by Seelye, Stevenson, Value and Knecht, Consulting Engineers, March 15, 1977.
- e. Design Report, Addendum No. 1, Revisions to Means Brook Reservoir Spillway for Bridgeport Hydraulic Company, March 31, 1977.
- f. Plan of Lower Gate House, Means Brook Reservoir.
- g. Plan of Upper Gate House, Means Brook Reservoir.

2.2 Construction

This dam was constructed in 1917. Review of the contract plans for the 1977 revisions showed that the modifications to the dam were limited to lengthening of the spillway and spillway channel (raceway), spillway rehabilitation, extension of the pipe bridge over the widened raceway, construction of a 2.1 foot wall on the dam's crest and other minor modifications to some appurtenant structures. These revisions were implemented as the result of a 1973 inspection of the dam. A copy of this inspection report is contained in Appendix B.

2.3 Operation

The operation of the dam is for the purpose of water supply, and therefore, the water level for this dam is established on the basis of the water supply demand. However, there is no written procedure that has been established for this purpose.

2.4 Evaluation

- a. Availability:** The information noted above for this facility is available in the files of the Department of Environmental Protection, Water and Related Resources Unit, Dam Safety Engineers, State Office Building, Hartford, Connecticut, and the Bridgeport Hydraulic Company, 835 Main Street, Bridgeport, Connecticut.
- b. Adequacy:** The information that was available complemented a complete visual inspection of the dam. Since there were no signs of major distress, the information is adequate at this time.
- c. Validity:** The validity of the 1977 design data appears good. The validity of the 1915 and 1916 plans could not be verified.

SECTION 3

VISUAL INSPECTION

3.1 Findings

- a. **General:** The visual inspection of the Means Brook Reservoir Dam was conducted on November 16, 1979 and a copy of the visual inspection check list is contained in Appendix A of this report.

The following procedure was used:

1. Inspection of the upstream area of the reservoir which was impounded by the dam.
2. Visual inspection of the face and crest of the dam and spillway for cracks, spalling, leakage, etc.
3. Inspection of the outlet works and other appurtenances as to their existence, location, and operability.
4. Review of procedures that could be utilized in the event of an emergency situation.
5. A check of the downstream area for seepage, piping, boils or other indications of abnormal conditions. The downstream hazard potential in the event of dam failure was investigated.
6. Photographs of the general area of the dam and of specific items of note were taken and are included in Appendix C of this report.

Before the inspection, the available existing data and aerial photographs were studied and reviewed.

b. **Dam**

1. **Crest:** The top of the dam is concrete with no evidence of settlement or misalignment. The top is spalled (Photo C-4) and there is visible reinforcing in a few locations along the edge of the top (Photo C-5). A 2.1 foot high concrete wall was added to the upstream edge of the dam's crest in 1977 (Photo C-5).

The top of the dam has a width of 10 feet and support pipe railing (good condition) on both the upstream and downstream edges (Photo C-4).

2. **Upstream face:** The upstream face of the dam is concrete with a vertical face (Photo C-3). The water level at the time of the inspection was 5.6 feet below the top of the dam (wall). Spalling and efflorescence was noted.
3. **Downstream face:** The downstream face is concrete with a sloped face (see record drawings in Appendix B). Substantial spalling and efflorescence was noted on the downstream face (Photos C-1, C-2). Leakage at the toe in the center of the dam was reported in a 1977 inspection. However, no sign of any leakage was noted in the inspection for this report.

c. Appurtenant Structures

1. **Spillway:** The spillway is a 100 foot long and 6 foot wide concrete ogee crested weir with a drop of 3 feet to the raceway (Photos C-6, C-8). The spillway was widened and rehabilitated in 1977 and, except for leakage through a small crack (Photo C-7), and possible subsurface leakage, is in good condition. The spillway is located at the west abutment of the dam and is keyed into rock.
2. **Water Supply Outlets:** A 30 inch service main and a 10 inch auxiliary service drain water from the wet well of the upper gate house, through the dam, to the lower gate house. The 30 inch pipe is normally in use and expands to a 36 inch pipe which extends downstream to the Trap Falls Reservoir. The visible portions are rusted but appear in good condition and are reportedly operational. The 36 inch pipe can be drained to the raceway via a 12 inch blowoff.
3. **24 Inch Blowoff:** A 24 inch blowoff extends from the upstream face, through the dam, to the lower gate house. Gate valves in the lower gate house control the discharge in this pipe and are reportedly operational. A cross over pipe can permit flow between the 30 inch service main and the 24 inch blowoff. The 24 inch pipe continues from the lower gate house, transitions to a 16 inch pipe, and outfalls to the raceway at an endwall 160 feet below the dam (Photo C-12).
4. **Upper Gate House:** The upper gate house is a concrete structure in generally good condition (Photo C-4). The lift mechanisms for the wet well intake sluice gates are located in the house and appear operational (Photo C-11).
5. **Lower Gate House:** The lower gate house is a concrete structure in generally good condition (Photo C-2, building at toe of dam). Controls for the various gate valves are located in the house and appear operational. Pumps are also located in the house which may be utilized to increase the flow through the 36 inch pipe to the Trap Falls Reservoir.

d. Reservoir Area

The impoundment created by the dam is a flooded portion of the natural brook bed. There are fairly gentle slopes abutting the reservoir on the west side and steeper slopes on the east side.

The natural drainage area of the reservoir has been increased by the diversion of the Hurds Brook Watershed. This watershed flows through an unregulated 5 foot by 5 foot horseshoe shaped aqueduct just south of Webb Circle Road in the northwest portion of the drainage area.

No geologic features were detected that could be expected to adversely affect the dam or its appurtenant structures.

Trespassing on the dam is prohibited and the crest is fenced and locked. Access to the dam site is limited and the access road is chained and locked.

e. Downstream Channel

The spillway channel or raceway is cut into the valley slope at the west abutment below the spillway (Photos C-6, C-9). The floor of the channel is rock with a fairly steep gradient. Water was not flowing over the spillway, however, a substantial flow was noted in the raceway below the spillway (Photo C-6).

A pipe bridge for the 36 inch service main to Trap Falls Reservoir spans the raceway just upstream of the blowoff endwall (Photo C-10).

The raceway was expanded as part of the 1977 modifications to the dam.

3.2 Evaluation

Based on the visual inspection, the Means Brook Reservoir Dam appears to be in fair condition overall, and there were no major areas of distress noted. Specific areas of concern that were noted are:

The substantial spalling and efflorescence on the downstream face.

The subsurface flow to the raceway.

SECTION 4

OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

The responsibility for the operation and maintenance of this facility is with the Bridgeport Hydraulic Company. The maintenance staff is located at the Company headquarters in Bridgeport, Connecticut. These staff personnel make daily visits to the dam facility. During storm conditions, the Means Brook Reservoir Dam is monitored around the clock. These staff personnel operate and maintain the valves and equipment necessary to maintain the flow to the Trap Falls Reservoir for distribution in the water supply system. No written procedure is available for emergency operation of the blowoff system. The blowoff valve was last opened in 1977 to drain the reservoir during alterations to the dam.

4.2 Maintenance of the Dam

The maintenance of the dam is centered around those valves and sluice gates that control the water supply to the public water distribution system. The dam is superficially inspected by the Bridgeport Hydraulic Company on an annual basis. Records of these inspections are available from the Bridgeport Hydraulic Company.

4.3 Maintenance of the Operating Facilities

The operating facilities consist of a 36 inch sluice gate for the main water service intake, a 16 inch sluice gate for the auxiliary water service intake and a gate valve for the blowoff system. All valves are manually operated from within the gate houses. No specific testing of the valves is conducted.

4.4 Description of any Warning System in Effect

No formal emergency or contingency plan is in effect to reduce or minimize downstream damage in emergency situations.

4.5 Evaluation

The operation and maintenance of this dam could be oriented so that it more directly deals with procedures to be followed in case of an emergency situation.

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

The Means Brook Reservoir Dam creates an impoundment with a total storage capacity of 268 ac.-ft. at elevation 345.0, the spillway crest elevation. Each foot of depth in the reservoir above the spillway crest can accommodate approximately 20 ac.-ft. The natural drainage area has been increased by 1.88 square miles by the diversion of a portion of Hurds Brook to Means Brook. The stream bed of Means Brook above the dam is flat with an average slope of 1/4 percent. The spillway is a concrete ogee weir 100.0 feet in length and 5.1 feet below the top of the wall on the crest.

5.2 Design Data

- a. The available design data is limited to final design discharges by Seelye, Stevenson, Value and Knecht, Inc., for the 1977 spillway and top of dam modifications. Refer to Appendix B for location of this data. Design calculations were unavailable.
- b. The drainage area utilized in the 1977 design calculations was 5.77 square miles, which apparently did not include the 1.88 square mile watershed of Hurds Brook upstream of the diversion aqueduct. Inclusion of this watershed yields the total drainage area to the Means Brook Dam of 7.65 square miles used in this inspection report.
- c. To supplement and verify the existing design information, USGS topographic maps (scale 1"=2000') were utilized to develop hydrologic parameters such as drainage area, basin length, time of concentration, and other runoff characteristics. Elevation-storage relations for the reservoir were approximated. Reservoir surface area and surcharge storage was computed using the USGS maps. Some of the pertinent hydraulic design data was obtained and/or confirmed by actual field measurements at the time of the visual inspection.
- d. Outflow values (routing procedures) and dam overtopping analyses were computed in accordance with the guidelines developed by the Corps of Engineers. Judgment was used in calculating final values outlined in this report, which are quite approximate and should not be considered a substitute for actual detailed analysis.

5.3 Experience Data

Historical data for recorded discharges is available for this dam. The maximum discharge to date occurred in October, 1955 and was calculated to be approximately 2000 cfs, corresponding to a reported water level of 4 inches over the top of the dam. The spillway was 76.5 feet long, the wall on the dam's crest did not exist, and the top of the dam was 407 feet long at this time.

5.4 Test Flood Analysis

Recommended guidelines for the Safety Inspection of Dams by the Corps of Engineers were used for the selection of the "Test Flood". This dam is classified as a HIGH hazard and INTERMEDIATE size structure. Guidelines indicate that the Probable Maximum Flood (PMF) be used as the "Test Flood": for these classifications. The watershed has a total area of 7.65 square miles. Snyder's lag was calculated to be 5.2 hours and a Snyder peaking coefficient of 0.625 was used. The 200 square mile - 24 hour Probable Maximum Precipitation (PMP) is 22 inches. The flood hydrograph package, HEC-1 computer program, developed by the Corps of Engineers was utilized to develop the inflow hydrograph, route the flood through the reservoir, and for the dam overtopping analysis. A test flood inflow equal to the PMF was calculated to be 7800 cfs, or 1020 cfs/sq. mi. (drainage area equal to 7.65 square miles). The inflow from 1/2 PMF was calculated to be 3900 cfs or 510 cfs/sq. mi. This correlates well with the 1977 calculated value of the design discharge (1/2 PMF) of 2850 cfs or 490 cfs/sq. mi. (drainage area equal to 5.77 square miles).

The spillway capacity is hydraulically inadequate to pass the "Test Flood" (PMF) and overtopping of the dam will occur. The maximum outflow capacity of the spillway without overtopping the dam is 4000 cfs. This corresponds to 51 percent of the test flood and a storage above the spillway crest of 105 ac.-ft. The maximum outflow discharge value for the test flood is 7800 cfs corresponding to a depth of flow over the top of dam of 1.4 feet and a storage above the spillway level of 144 ac.-ft. The outflow from 1/2 PMF is equal to 3900 cfs. A spillway rating curve, low level outlet rating curve and a reservoir surface area-capacity curve are included in Appendix D of this report.

At the spillway crest elevation of 345.0, the capacity of the 16 inch outlet structure is 42 cfs and approximately 113 cfs are withdrawn via the 30 inch supply main. It will require approximately 2 hours to lower the water level the first foot assuming a water surface area of 18.4 acres, normal inflow conditions and use of the outlet works to regulate the water level for expected inflows.

5.5 Dam Failure Analysis

This dam is classified as a HIGH hazard structure. Failure discharge can cause damage due to high velocities, impact from debris, and flooding to 25-30 residential homes and urban areas along the downstream channel.

The calculated dam failure discharge is 19600 cfs at a pool level equal to the spillway crest. This pool level was chosen instead of the top of the dam level as having the greater hazard potential because a pre-failure flow of 4000 cfs (maximum spillway capacity) would have caused evacuation and/or a warning of flood conditions downstream of the dam. Failure of the dam at normal pool level would catch the downstream area off guard and probably result in greater losses. Failure will produce a water surface level approximately 16.0 feet immediately downstream from the dam which would completely inundate the lower gate house and pump house. The failure discharge will effect downstream areas for a distance of 11500 feet from the dam where approximately 25 - 30 residential homes will be inundated by 2 - 5 feet of water. At this distance, the water surface level will be approximately 2.0 feet above normal observations as it enters the Farmill River. Beyond 11500 feet, the effects of the failure discharge will be reduced as it enters the Farmill River. Water surface elevations, due to the failure of the dam, are listed in Appendix D. Probable consequences including the prime impact areas are also listed in Appendix D.

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

Since no major physical distress or movement has been noted since the construction of this dam in 1917, stability does not appear to be a problem. On the downstream face, the concrete shows signs of spalling and efflorescence. A 2.1 foot concrete wall was added to this structure and the spillway was widened in 1977. Reinforcement is visible in a few places along the edges of the crest.

6.2 Design and Construction Data

There are plans available from the 1917 construction. However, it was not until 1977 that a design analysis was available which was done in conjunction with the revisions that were made to the Means Brook Spillway. The structural analysis done by Seelye, Stevenson, Value and Knecht assumed several loading conditions to check the stability of the structure. Refer to Appendix B for location of this data. Conventional structural analysis methods were employed, however, to establish its conformity with the Corps of Engineers Recommended Guidelines for a Phase II analysis, it appears that other loading conditions will have to be studied.

Other than the contract plans there were no available construction records of the 1977 modifications to the top of the dam and the spillway.

6.3 Post-Construction Changes

Prompted by a 1973 inspection of the dam, the 1977 modifications to the top of the dam and the spillway were performed. The abutments for the pipe bridge at the bottom of the raceway were relocated and modified to increase the hydraulic capacity. Minor changes to the downstream training walls and riprap limits were performed to improve flow characteristics.

6.4 Seismic Stability

The dam is in Seismic Zone 1 and hence does not require evaluation for seismic stability according to the Corps of Engineers Recommended Guidelines.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment

- a. **Condition:** Based on the visual inspection, past performance and hydraulic/hydrologic evaluation, the Means Brook Reservoir Dam and appurtenances is judged to be generally in FAIR condition. Items of concern that should be addressed as a result of this inspection are listed in Sections 7.2 and 7.3.
- b. **Adequacy of Information:** The existing engineering data did not allow for a complete review. Therefore, the adequacy of the dam is also based on visual inspection, past performance history, and engineering judgment.
- c. **Urgency:** The recommendations and remedial measures described below should be implemented by the owner within one year after receipt of this Phase I Inspection Report.

7.2 Recommendations

It is recommended that the owner engage a qualified registered engineer to carry out the following actions and that his recommendations be implemented.

- a. An investigation as to the source and cause of the subsurface flow beneath the spillway.
- b. The upstream face of the dam be visually inspected.
- c. The spalling on the downstream face and the top of the dam be rehabilitated to their original condition.
- d. A further analysis be conducted as to the structural stability of the dam.

7.3 Remedial Measures

- a. **Operational and Maintenance Procedures**
 - 1. The toe at the downstream face be monitored for signs of the reoccurrence of leakage.
 - 2. Develop a downstream warning and surveillance plan, to supplement the round-the-clock monitoring during heavy precipitation.

3. Institute a program of annual periodic technical inspection.

7.4 Alternatives

None.

APPENDIX A
INSPECTION CHECK LIST

INSPECTION CHECK LIST

PARTY ORGANIZATION

PROJECT MEANS BROOK RESERVOIR DAM DATE NOVEMBER 16, 1979

TIME 9:00 - 10:30 a.m.

WEATHER Partly Cloudy

W.S. ELEV. _____ U.S. _____ DN.S. _____

PARTY:

1. <u>R. Johnston, JPPA</u>	6. <u>V. Zanillo</u>	} Bridgeport Hydraulic Company
2. <u>R. Lyon, JPPA</u>	7. <u>J. Stone</u>	
3. <u>J. Chastanet, CWDD</u>	8. <u>M. Johnson</u>	
4. _____	9. _____	
5. _____	10. _____	

PROJECT FEATURE	INSPECTED BY	REMARKS
1. <u>Hydraulics</u>	<u>R. Johnston</u>	
2. <u>Structural</u>	<u>R. Lyon</u>	
3. <u>Geotechnical</u>	<u>J. Chastanet</u>	
4. _____		
5. _____		
6. _____		
7. _____		
8. _____		
9. _____		
10. _____		

INSPECTION CHECK LIST

PROJECT MEANS BROOK RESERVOIR DAM DATE NOVEMBER 16, 1979
 PROJECT FEATURE _____ NAME _____
 DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
<u>DAM EMBANKMENT</u>	Concrete - Wall on crest added in 1977.
Crest Elevation 348.0	Good - Minor spalling and some visible reinforcement at edges 3.5 feet below crest
Current Pool Elevation 344.5	4 inches over crest in 1955
Maximum Impoundment to Date	Substantial spalling on downstream face
Surface Cracks	N/A
Pavement Condition	None observed
Movement or Settlement of Crest	None observed
Lateral Movement	Good
Vertical Alignment	Good
Horizontal Alignment	Good - Spillway at west abutment
Condition at Abutment and at Concrete Structures	N/A
Indications of Movement of Structural Items on Slopes	Not permitted
Trespassing on Slopes	Grass, two bushes on side slopes
Vegetation on Slopes	Substantial spalling on downstream face
Sloughing or Erosion of Slopes or Abutments	N/A
Rock Slope Protection - Riprap Failures	None observed
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	None observed
Piping or Boils	None observed
Foundation Drainage Features	None observed
Toe Drains	None observed
Instrumentation System	None observed

INSPECTION CHECK LIST

PROJECT MEANS BROOK RESERVOIR DAM

DATE NOVEMBER 16, 1979

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED

CONDITION

OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE

a. Approach Channel

Entire lake bed - underwater

b. Intake Structures

24 Inch Blowoff Intake

A free access inlet at the base of the dam on the upstream face of the upper gate house. Last utilized in 1977 to drain the reservoir.

36 Inch Main Intake

A 36 inch sluice gate controls discharge into the well of the upper gate house. Gate controlled by a lift mechanism in the gate house and is currently in the open position. Reportedly closed in 1977.

16 Inch Auxiliary Intake

A 16 inch sluice gate also allows discharge into the well of the upper gate house. Gate controlled by a lift mechanism in the gate house. Normally closed, but reportedly operational.

INSPECTION CHECK LIST

PROJECT MEANS BROOK RESERVOIR DAM

DATE NOVEMBER 16, 1979

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - CONTROL TOWFR</u>	Upper gate house
a. Concrete and Structural	
General Condition	Good
Condition of Joints	Good
Spalling	Minor on exterior
Visible Reinforcing	None observed
Rusting or Staining of Concrete	None observed
Any Seepage or Efflorescence	None observed
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	None observed
Cracks	Minor cracks in wall above water line
Rusting or Corrosion of Steel	None observed
b. Mechanical and Electrical	
Air Vents	None observed
Float Wells	N/A
Crane Hoist	Mechanical chain hoists for screens
Elevator	N/A
Hydraulic System	N/A
Service Gates	36 inch sluice gate
Emergency Gates	16 inch auxiliary gate
Lightning Protection System	None observed
Emergency Power System	None observed
Wiring and Lighting System in Gate Chamber	Domestic lighting

INSPECTION CHECK LIST

PROJECT MEANS BROOK RESERVOIR DAMDATE NOVEMBER 16, 1979

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - TRANSITION AND CONDUIT</u>	
30 Inch Service Main	A 30 inch cast iron pipe extends from the well in the upper gate house, through the dam, to a 30 inch valve in the lower gate house. A 36 inch cast iron pipe continues from the lower gate house to Trap Falls Reservoir, 2.8 miles south fo the dam.
10 Inch Auxiliary Service	A 10 inch cast iron pipe extends from the well in the upper gate house, through the dam, to a 10 inch valve in the lower gate house. The pipe then feeds into the 36 inch service main in the base-ment of the lower gate house.
24 Inch Blowoff	A 24 inch pipe extends from the inlet, through the dam, to a 24 inch valve in the lower gate house. The 24 inch pipe continues through the house reducing to a 16 inch pipe before the outlet. A 24 inch pipe and valve in the lower gate house can permit flow between the 36 inch service main and the 24 inch blowoff.
8 Inch Drain	An 8 inch pipe extends from the upper gate house, through the dam, to an 8 inch valve in the lower gate house. The 8 inch pipe then feeds into the 24 inch blowoff in the basement of the lower gate house.
A-5	

INSPECTION CHECK LIST

PROJECT MEANS BROOK RESERVOIR DAM

DATE NOVEMBER 16, 1979

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED

CONDITION

OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL

36 Inch Service Main

The 36 inch pipe may be drained, to the raceway, via a 12 inch pipe to an endwall below the dam. The 36 inch pipe continues to a discharge at Trap Falls Reservoir.

24 Inch Blowoff

The 24 inch pipe reduces to a 16 inch pipe and outlets, to the raceway, at an endwall below the dam.

Outlet Channel

A short channel extends from the endwall to the raceway. The channel is overgrown with grass and brush.

INSPECTION CHECK LIST

PROJECT MEANS BROOK RESERVOIR DAM

DATE NOVEMBER 16, 1979

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	Spillway widened and rebuilt in 1977.
a. Approach Channel	Entire lake bed - underwater
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
b. Weir	
General Condition of Concrete	Good - Rebuilt in 1977
Rust or Staining	None observed
Spalling	None observed
Any Visible Reinforcing	None observed
Any Seepage or Efflorescence	Small leak through hairline crack.
Drain Holes	None observed
c. Discharge Channel (raceway)	
General Condition	Good
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	None observed
Floor of Channel	Rock
Other Obstructions	Pipe bridge for 36 inch service main

APPENDIX B
ENGINEERING DATA

APPENDIX B-1

DESIGN, CONSTRUCTION AND MAINTENANCE RECORDS AND LOCATION

**Mr. Victor J. Galgowski
Dam Safety Engineer
Water and Related Resources Unit
Department of Environmental Protection
State of Connecticut
State Office Building
Hartford, Connecticut 06115**

**Bridgeport Hydraulic Company
835 Main Street
Bridgeport, Connecticut 06609**

APPENDIX B-2
COPIES OF PAST INSPECTION REPORTS

BUCK & BUCK
E N G I N E E R S

98 WADSWORTH STREET, HARTFORD, CONNECTICUT 06106

JAMES A. THOMPSON
ROBINSON W. BUCK
LAWRENCE F. BUCK

HENRY WOLCOTT BUCK
1891-1865
ROBINSON D. BUCK
1895-1859

COMM. 5713-74

April 24, 1973

Mr. Victor Galgowski
Supt. of Dams
Dept. of Environmental Protection
State Office Building
Hartford, CT 06106

RE: Means Brook Reservoir Dam, Shelton

Dear Vic:

We inspected the subject dam on April 12th and noted sandbags on top of same. If the sandbags were placed there to prevent overtopping of the structure, it means that the spillway capacity is inadequate. We recommend that you request an engineering report of this matter from the owner.

During our inspection we also noted a hole in the westerly embankment, 10' ± downstream from the face of the dam and 20' ± east of the east wall of the spillway. The masonry endwall of the spillway discharge channel has been partially broken away and there is evidence that flow has escaped the channel at some time in the past. The recommended engineering report should also include proposed remedial measures for the last two items mentioned.

Sincerely,
BUCK & BUCK


James A. Thompson

JAT:d1b

**WATER & RELATED
RESOURCES
RECEIVED**

APR 26 1973

B-3

ANSWERED _____
REFERRED _____
FILED _____

No. SH-19

WATER RESOURCES COMMISSION
SUPERVISION OF DAMS
INVENTORY DATA

Long 73-09.2

CT-92

Inventoried

By

WPS

Date 11 JUNE 1964

LA + 41-13.7

Name of Dam or Pond MEANS BROOK RESERVOIR

Code No. H 5.7 FM 4.6 MN 2.5

Nearest Street Location SAWMILL ROAD

Town SHELTON

U.S.G.S. Quad. LONG HILL

Name of Stream MEANS BROOK

Owner BRIDGEPORT HYDRAULIC COMPANY

Address 835 MAIN STREET

BRIDGEPORT 367-6621

OK 12/78

1917

Pond Used For WATER SUPPLY OF 765 SM

Dimensions of Pond: Width 500 FEET Length 1200 FEET Area 15 ACRES

Total Length of Dam 400 FEET Length of Spillway 63 FEET

INCREASED TO 100' SINCE '78

Location of Spillway WEST SIDE OF DAM

Height of Pond Above Stream Bed 35 FEET

Height of Embankment Above Spillway 5 FEET

Type of Spillway Construction CONCRETE

Type of Dike Construction CONCRETE

Downstream Conditions WOODS, ROADS

Summary of File Data

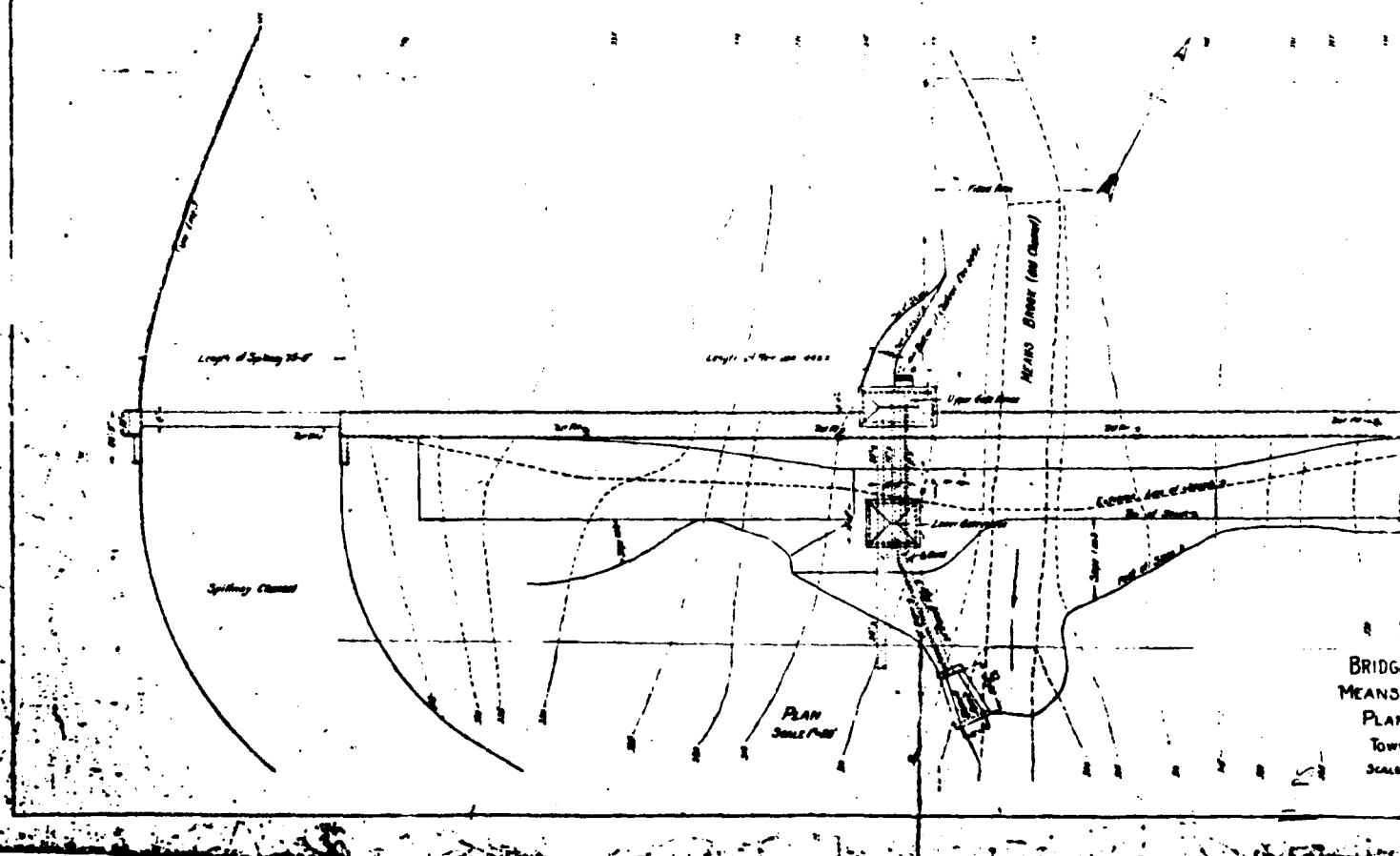
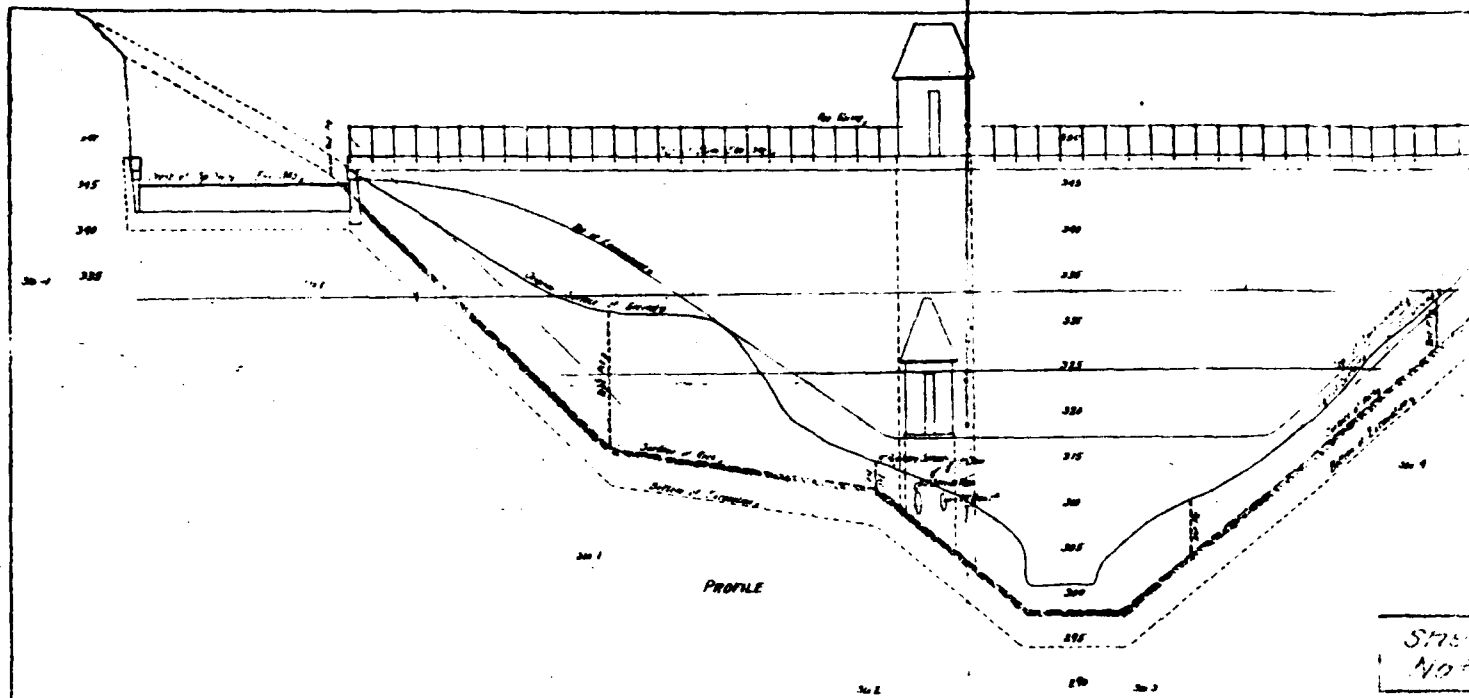
Remarks SLIGHT SPALLING OF CONCRETE NOTED ON

DOWNSTREAM FACE OF DAM

Would Failure Cause Damage? YES Class B

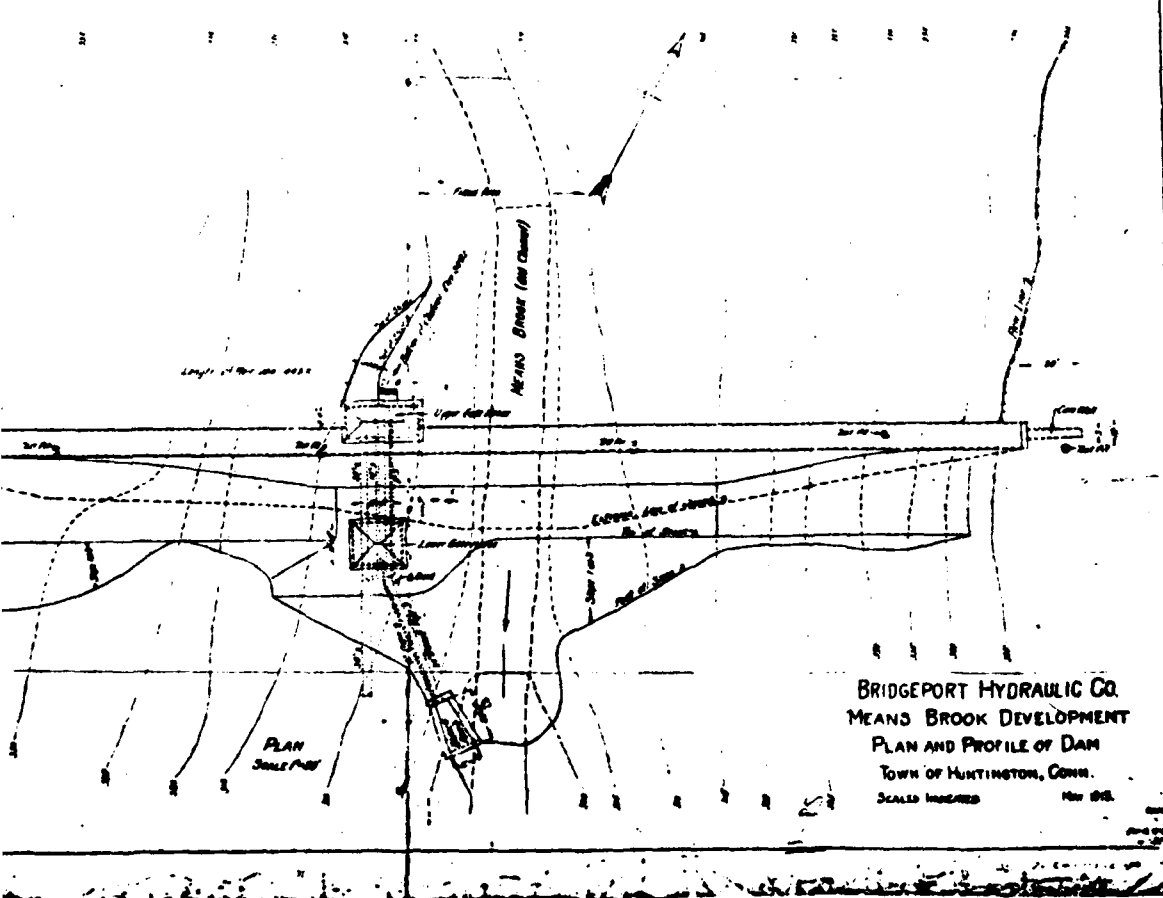
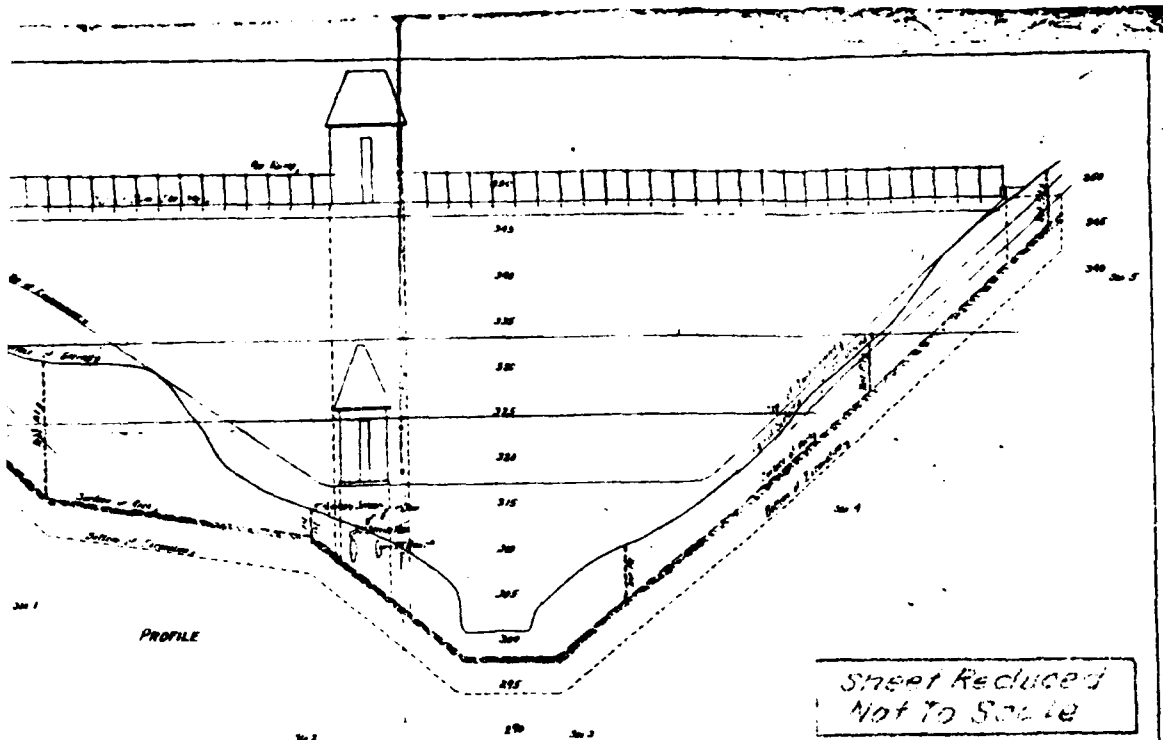
2-3-73 - 2" water not used, great air ...
... and large - large ...
4-12-73 INSPECTED WITH SGT THOMPSON OF ...
3-14-77 Supper along to about center of ...
monitored. Co. is preparing plans to provide more
spilling cap. 1750

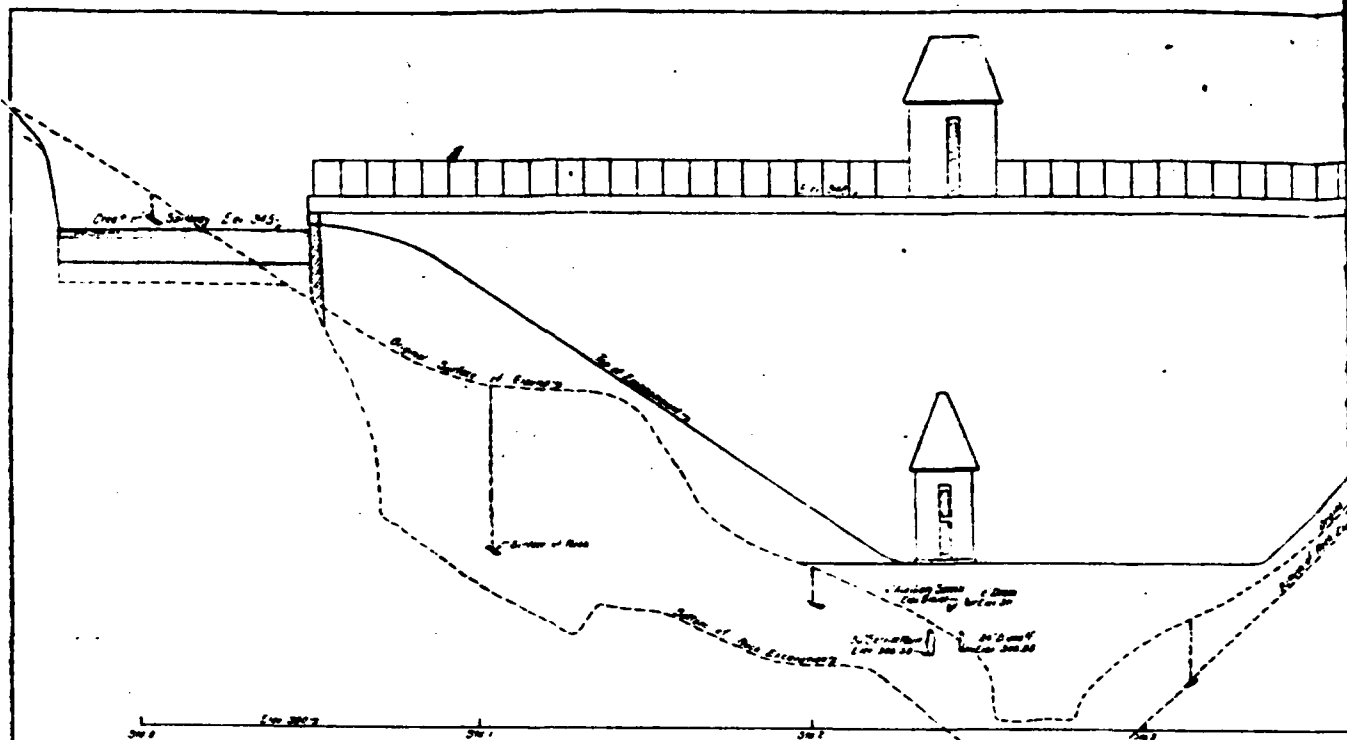
APPENDIX B-3
RECORD DRAWINGS AND SKETCHES



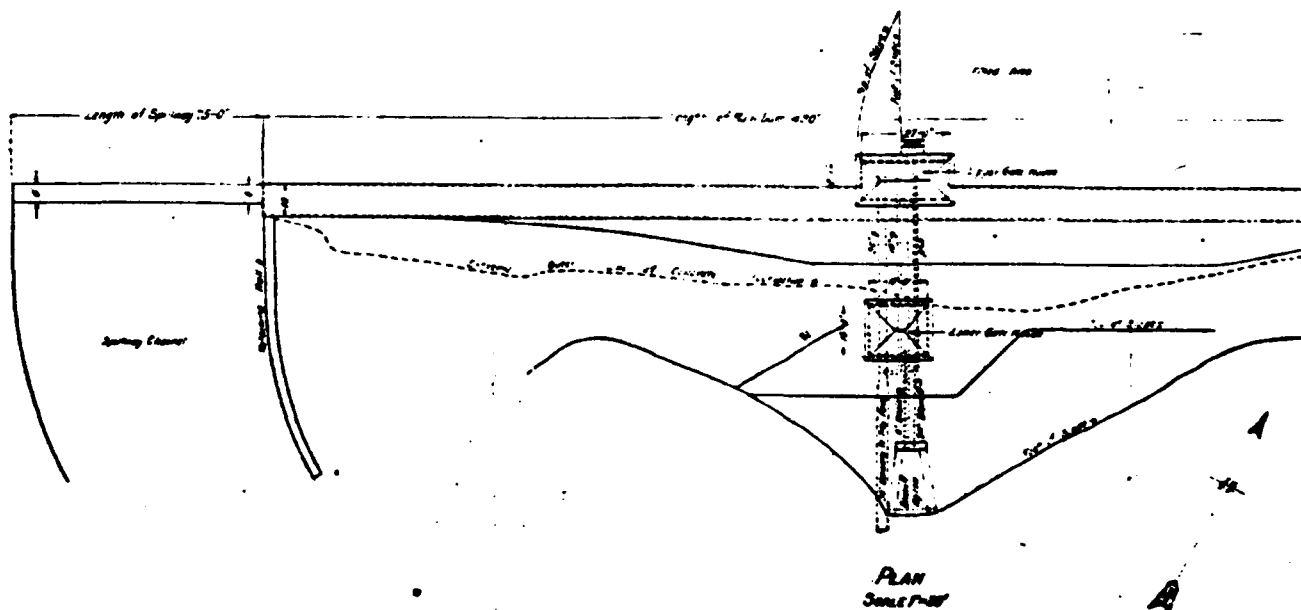
B-7

BRIDGE
MEANS
PLAN
TOWN
SCALE



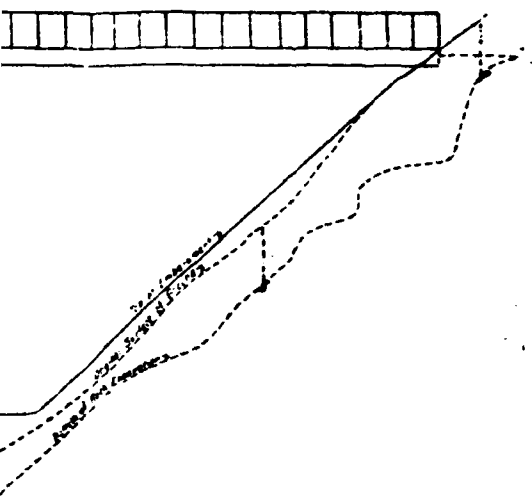


PROFILE
 SCALES (HORIZ. 1" = 20'
 VERT. 1" = 6')

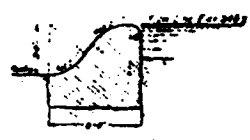


PLAN
 SCALE 1" = 20'

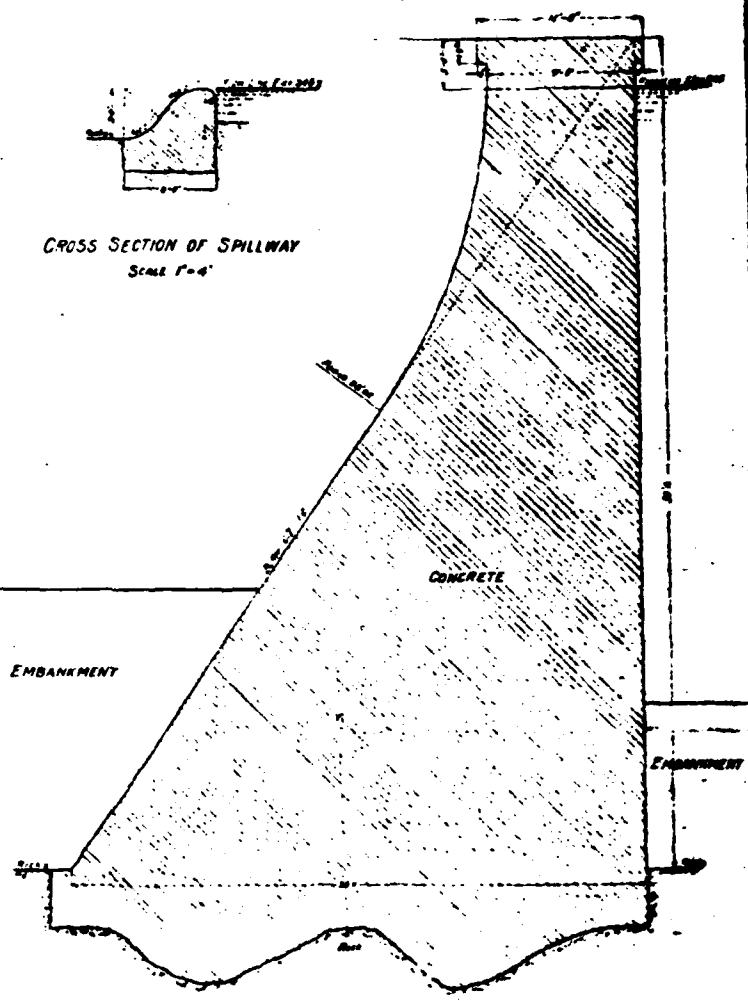
38-2



CROSS SECTION OF SPILLWAY
Scale 1"=4'



EMBANKMENT



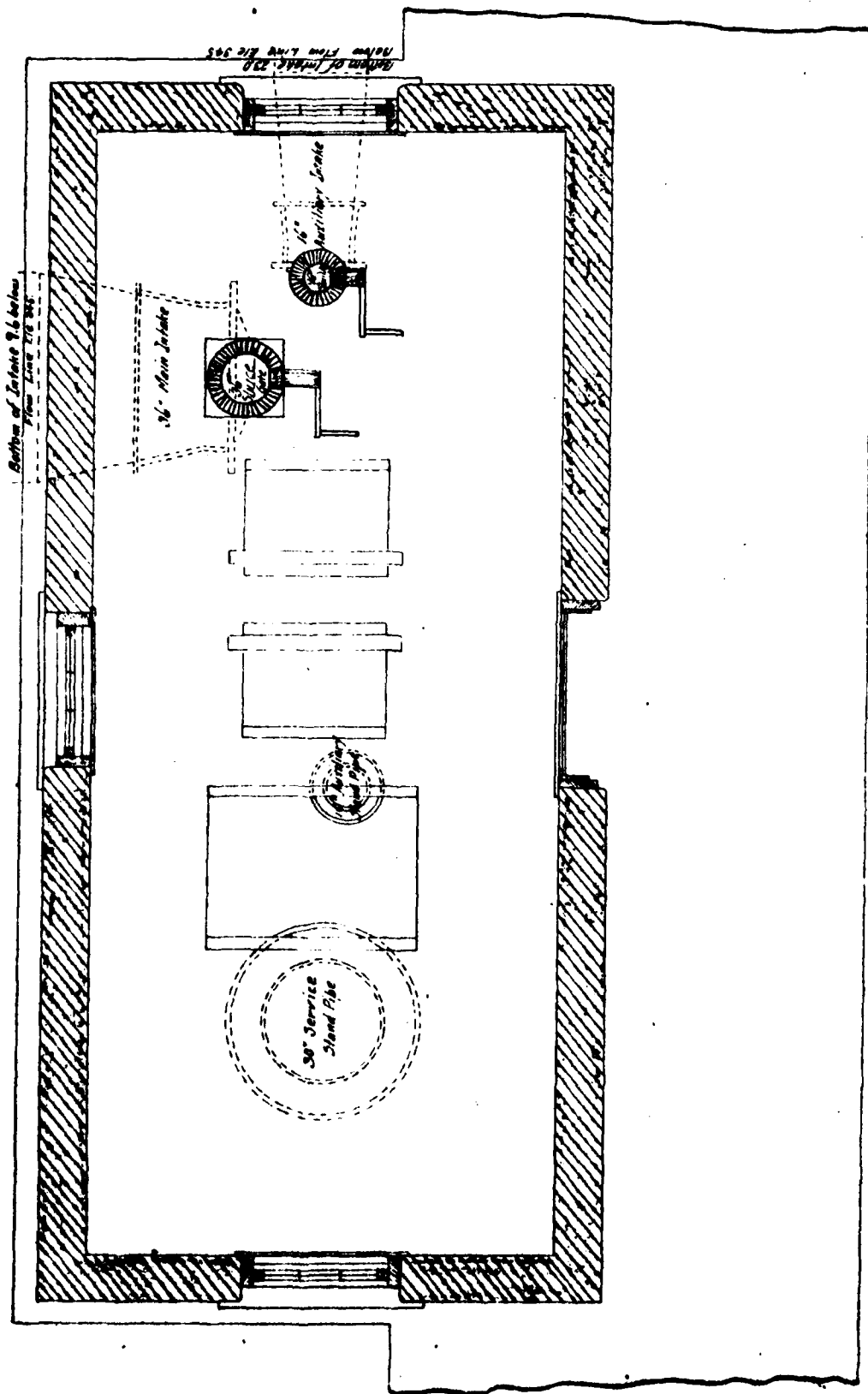
MAXIMUM CROSS SECTION OF DAM
Scale 1"=4'

BRIDGEPORT HYDRAULIC CO.
MEANS BROOK DEVELOPMENT
PLAN, PROFILE AND CROSS SECTION OF DAM
TOWN OF HUNTINGTON, CONN.
SCALES INDICATED FEBRUARY, 1900

Sheet Reduced
Not To Scale

38-2

LI-W

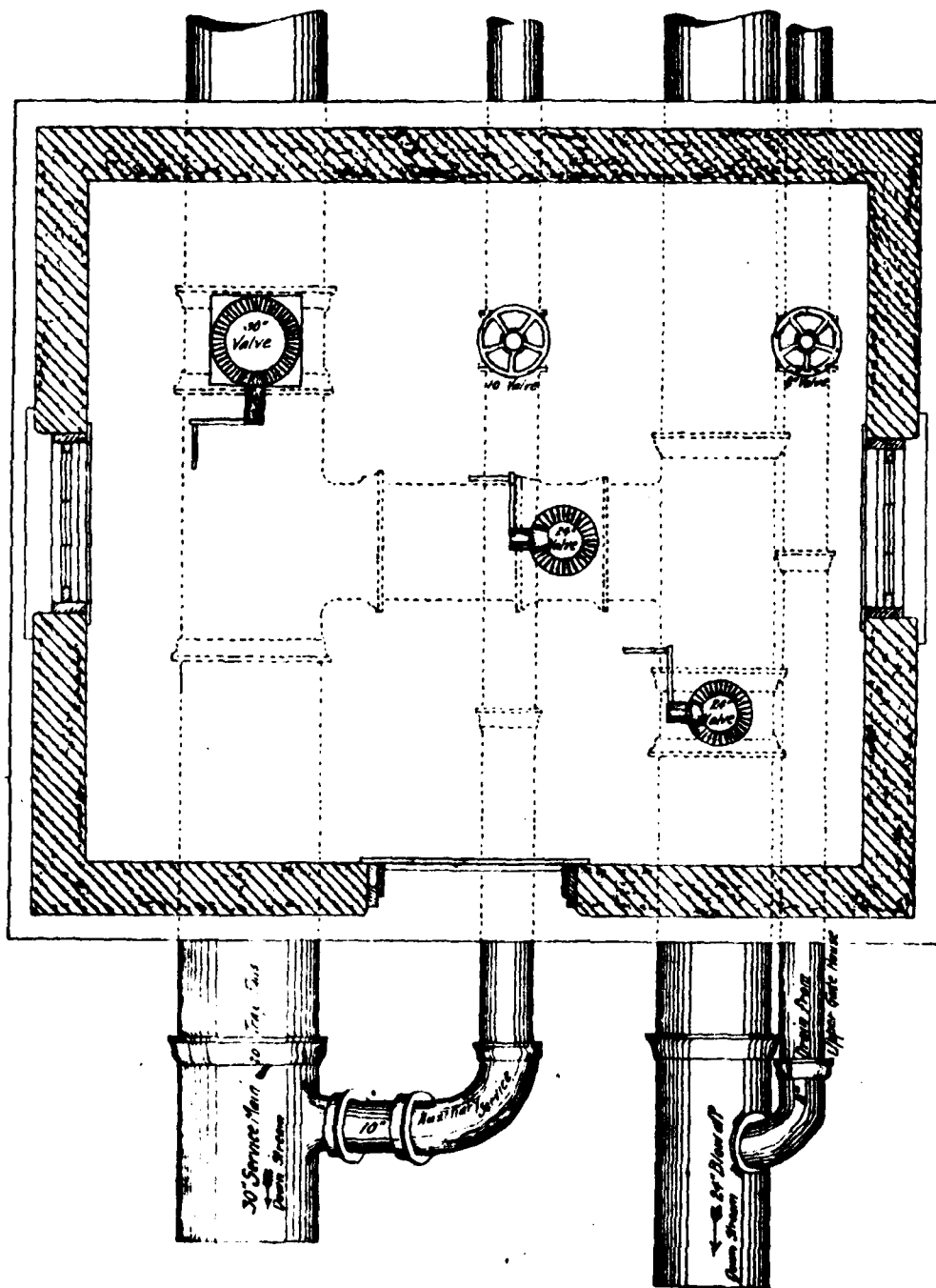


SECTIONAL PLAN OF UPPER GATE HOUSE
MEANS BROOK RESERVOIR

E 14

Scale 1" = 1' 0"

Sheet Reduced
Not To Scale



SECTIONAL PLAN OF LOWER GATE HOUSE
MEANS BROOK RESERVOIR

Sheet Reduced
Not To Scale

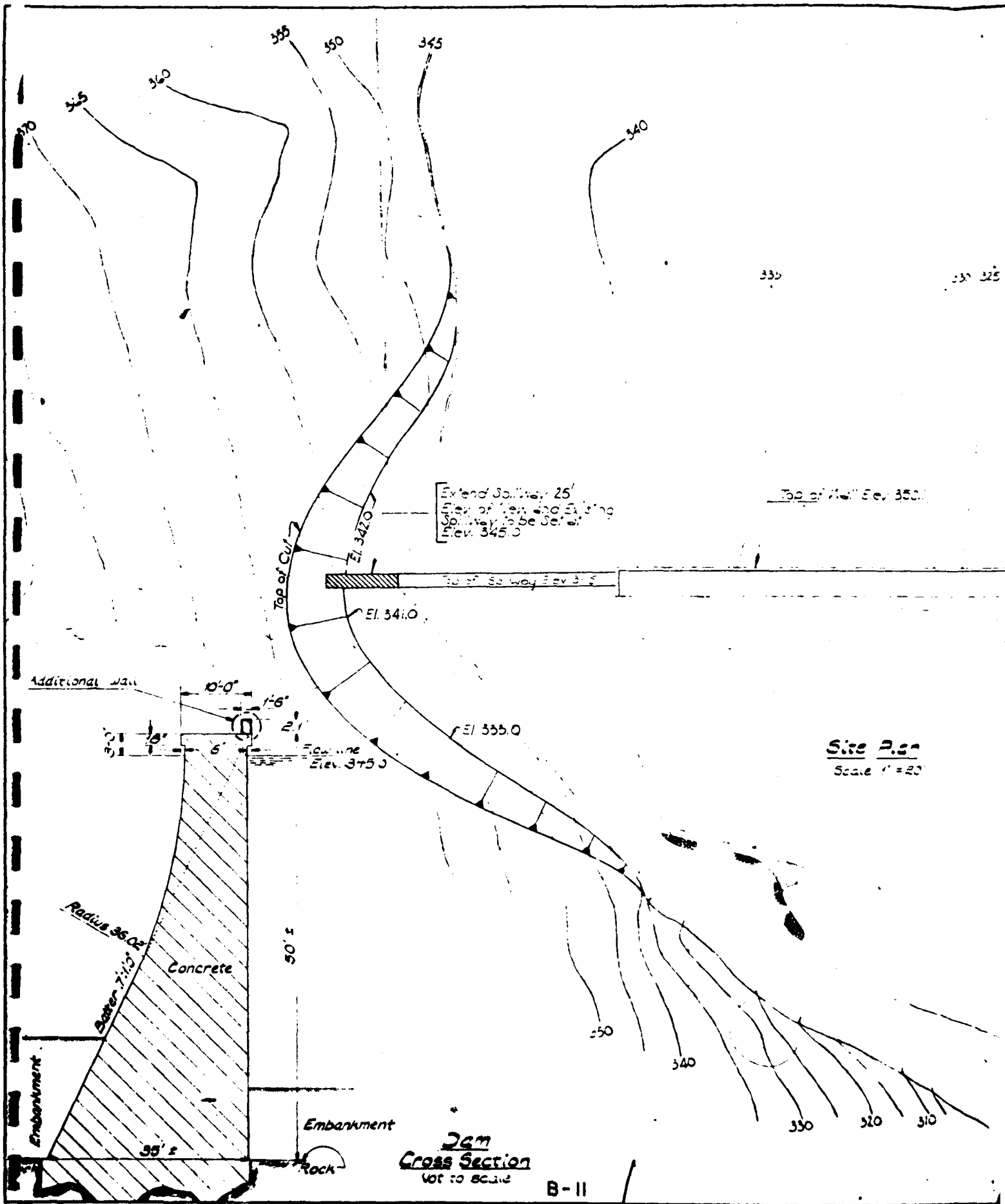
14

Scale 1" = 1 Foot

B-10

MICROFILMED DATE

M-17



320 325 330 335 340 345 350 355 360 365 370 375 380 385 390 395 400 405 410 415 420 425 430 435 440 445 450 455 460 465 470 475 480 485 490 495 500 505 510 515 520 525 530 535 540 545 550 555 560 565 570 575 580 585 590 595 600 605 610 615 620 625 630 635 640 645 650 655 660 665 670 675 680 685 690 695 700 705 710 715 720 725 730 735 740 745 750 755 760 765 770 775 780 785 790 795 800 805 810 815 820 825 830 835 840 845 850 855 860 865 870 875 880 885 890 895 900 905 910 915 920 925 930 935 940 945 950 955 960 965 970 975 980 985 990 995

350

Top of Dam Elev. 348

2.5
1" = 20'

APPROVED
STATE OF CONNECTICUT
DEPT. OF CONSERVATION
BY ORDER DATE 11-22-77
[Signature]

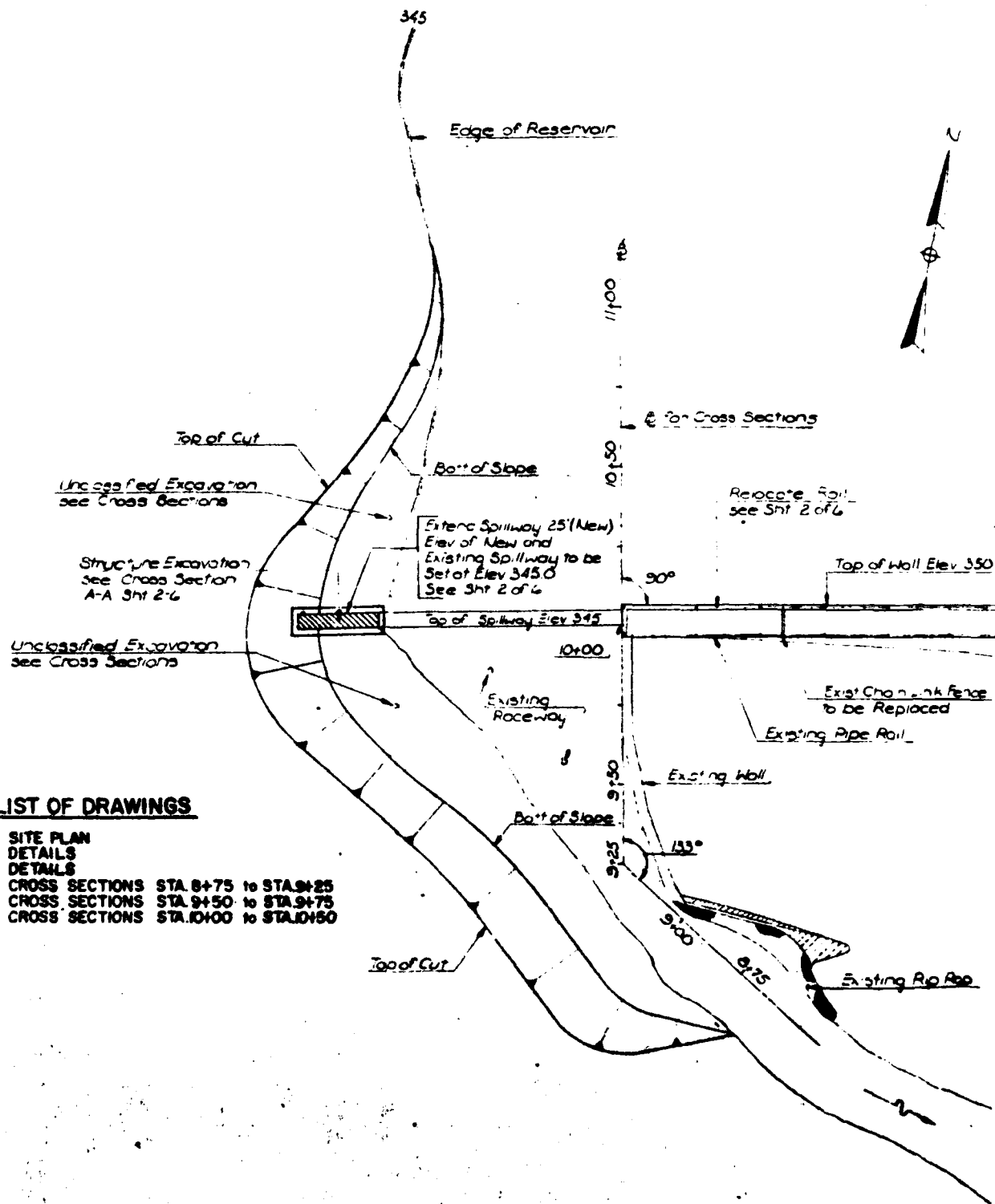
SCHEME NO. 5 B

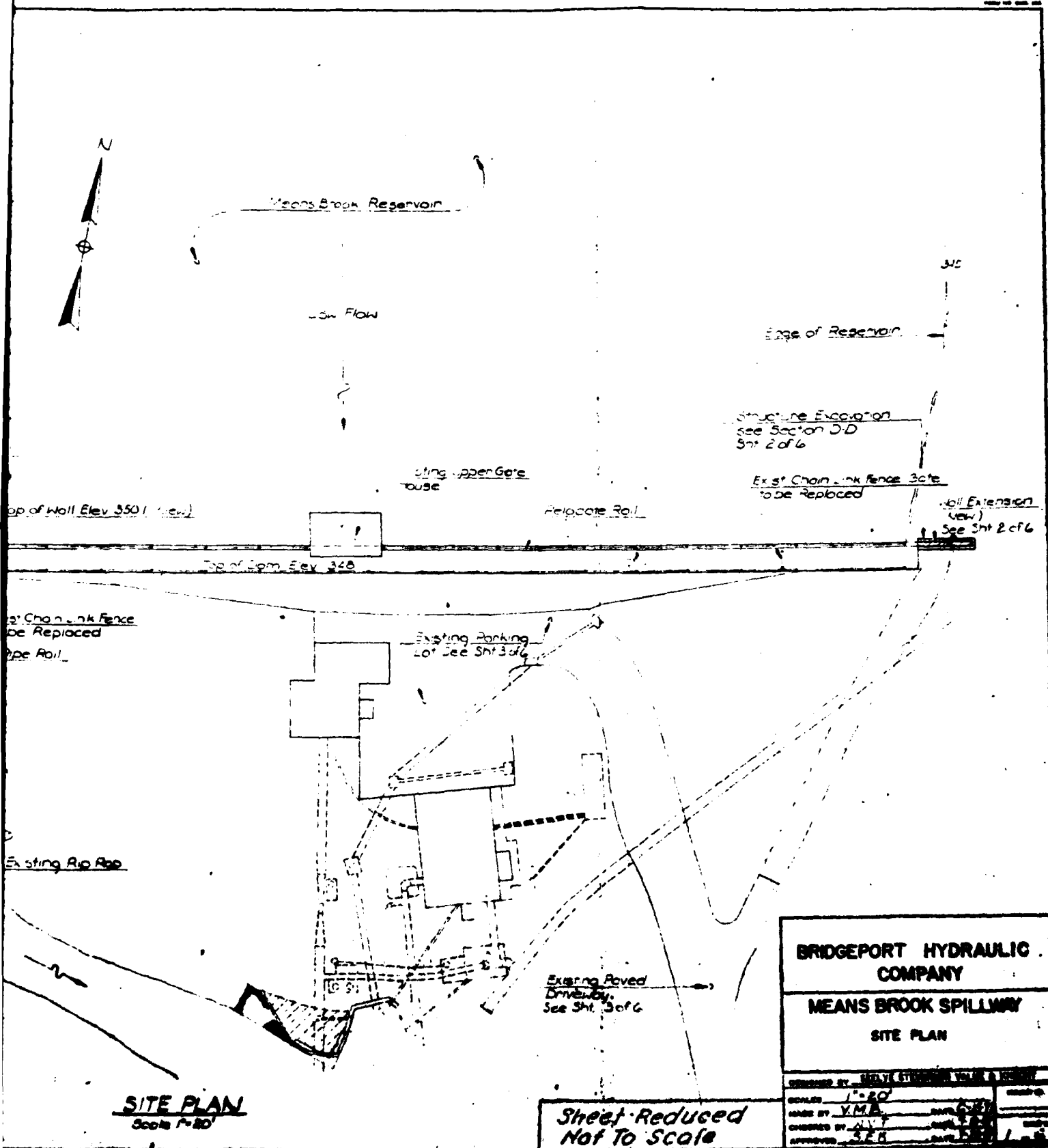
BRIDGEPORT HYDRAULIC
COMPANY

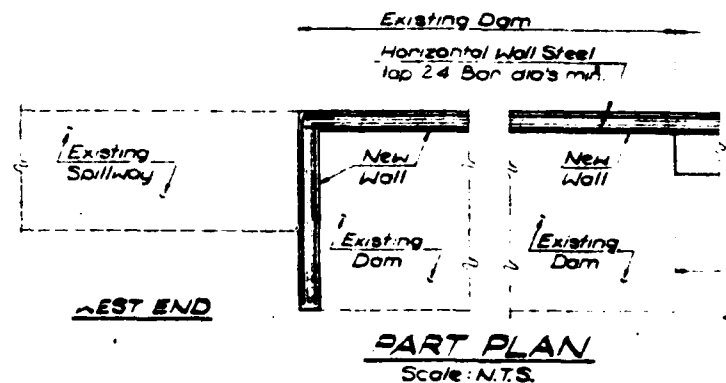
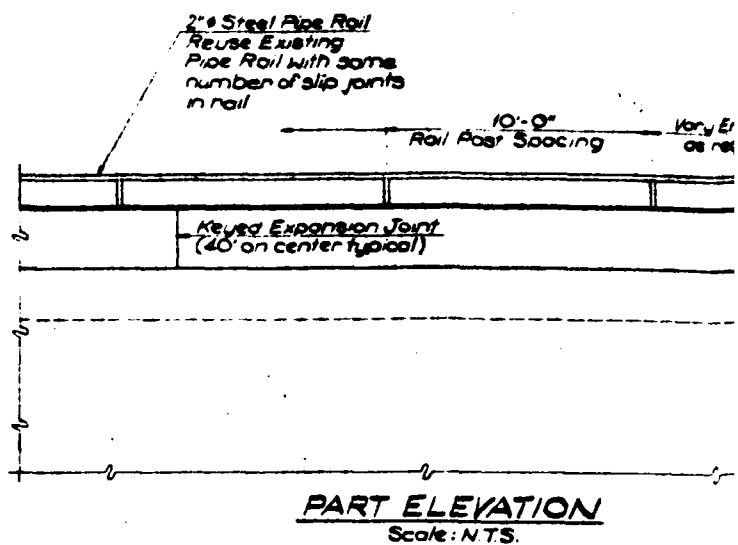
MEANS BROOK SPILLWAY
SITE PLAN

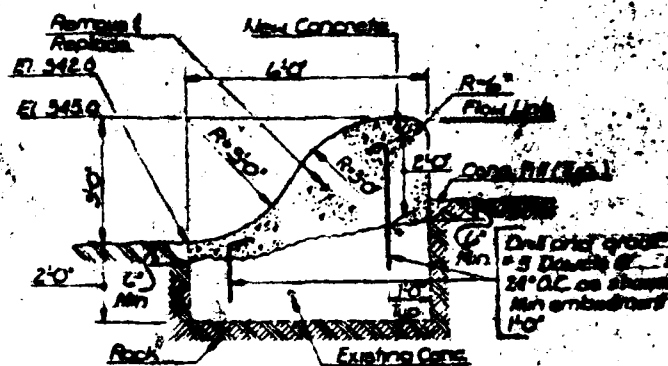
Sheet Reduced
Not To Scale

DESIGNED BY HELVY STEVENSON VALDE & KNECHT
SCALE As noted
MADE BY RB DATE 8-22-77
CHECKED BY SEA DATE 8-23-77
APPROVED _____ DATE _____









Scale 1/2"=1'-0"

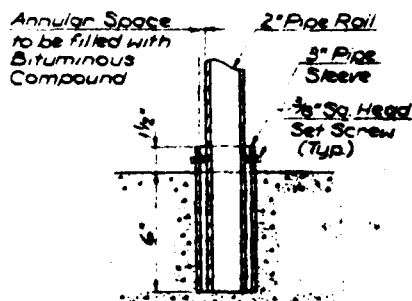
NOTE A

Structure Excavation Rev. Limits

Ray Limits shall be vertical, 2" outside the neat limits of the structure and from the bottom of the footing to Elev 345.0. For Section A-A and from the bottom of the footing to original ground for Section D-D.

Vote 2

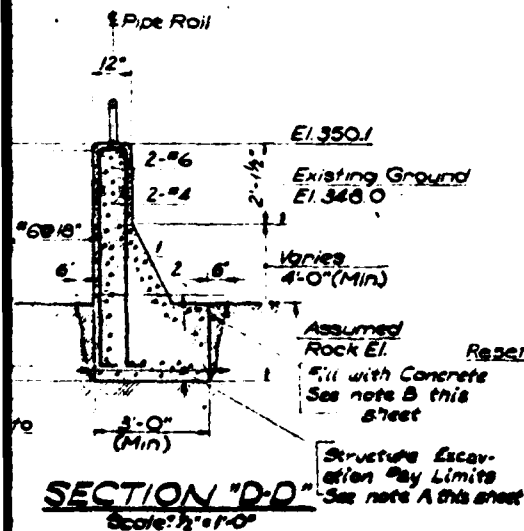
The excavation shall be completely filled with concrete to the top of adjacent rock surfaces. Structure excavation is to be made as close to the next limit of the structure as possible. Excavation beyond the payment limits shall not be paid. Excavation more than 2' outside the pay limits shall be backfilled with 3,000 lb. concrete to the pay limits, at the Excavation Contractors expense.



Sec/E: N.T.S.

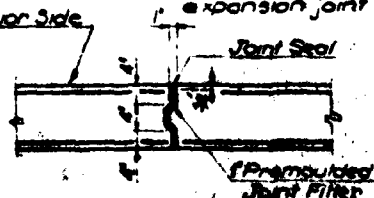
Note

Horizontal reinforcing
shall not pass through
expansion joint



Scale: 1/2" = 1'-0"

Structure Excavation Day Limits
See note A this sheet



JOINT DETAIL

SECRET

Sheet Reduced
Not To Scale

**BRIDGEPORT HYDRAULIC
COMPANY**

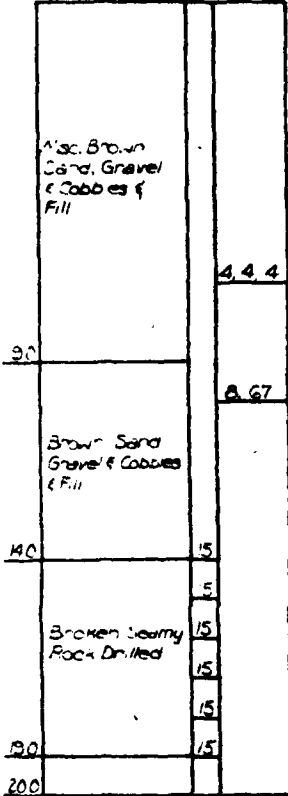
MEANS BROOK SPILLING

DETAILS

NAME: [REDACTED]
 GRADE: [REDACTED]
 SCHOOL: [REDACTED]
 ADDRESS: [REDACTED]
 CITY: [REDACTED]
 STATE: [REDACTED]
 ZIP: [REDACTED]

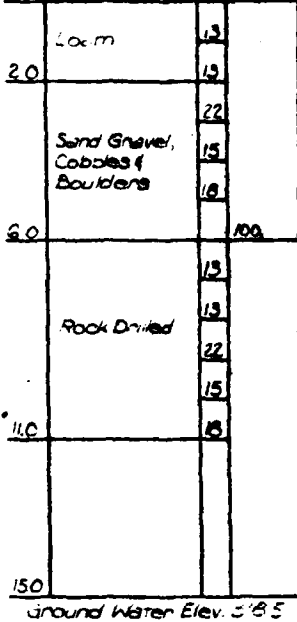
B-2

Surface Elev. 340.4



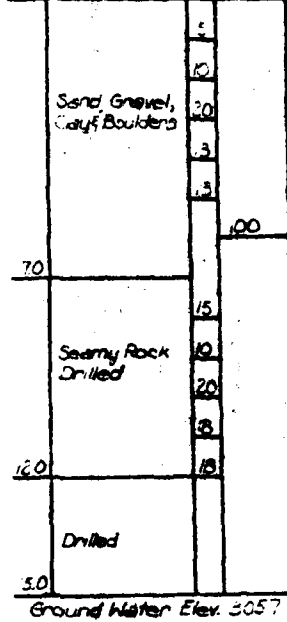
B-3

Surface Elev. 329.5



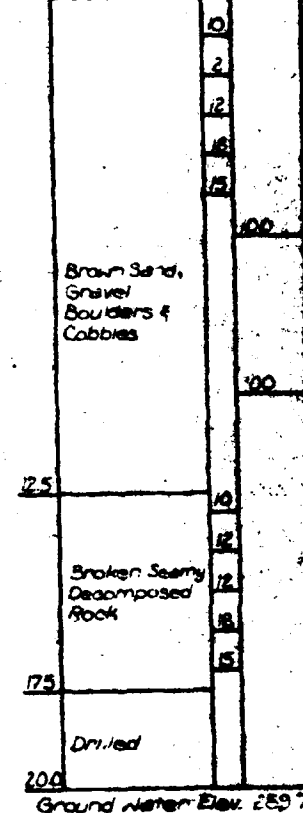
B-4

Surface Elev. 317.7



B-5

Surface Elev. 306.8



Note:

Figures at left indicate depth below ground surface of strata change.

Figures at center indicate Coring Time Per Ft (Min).

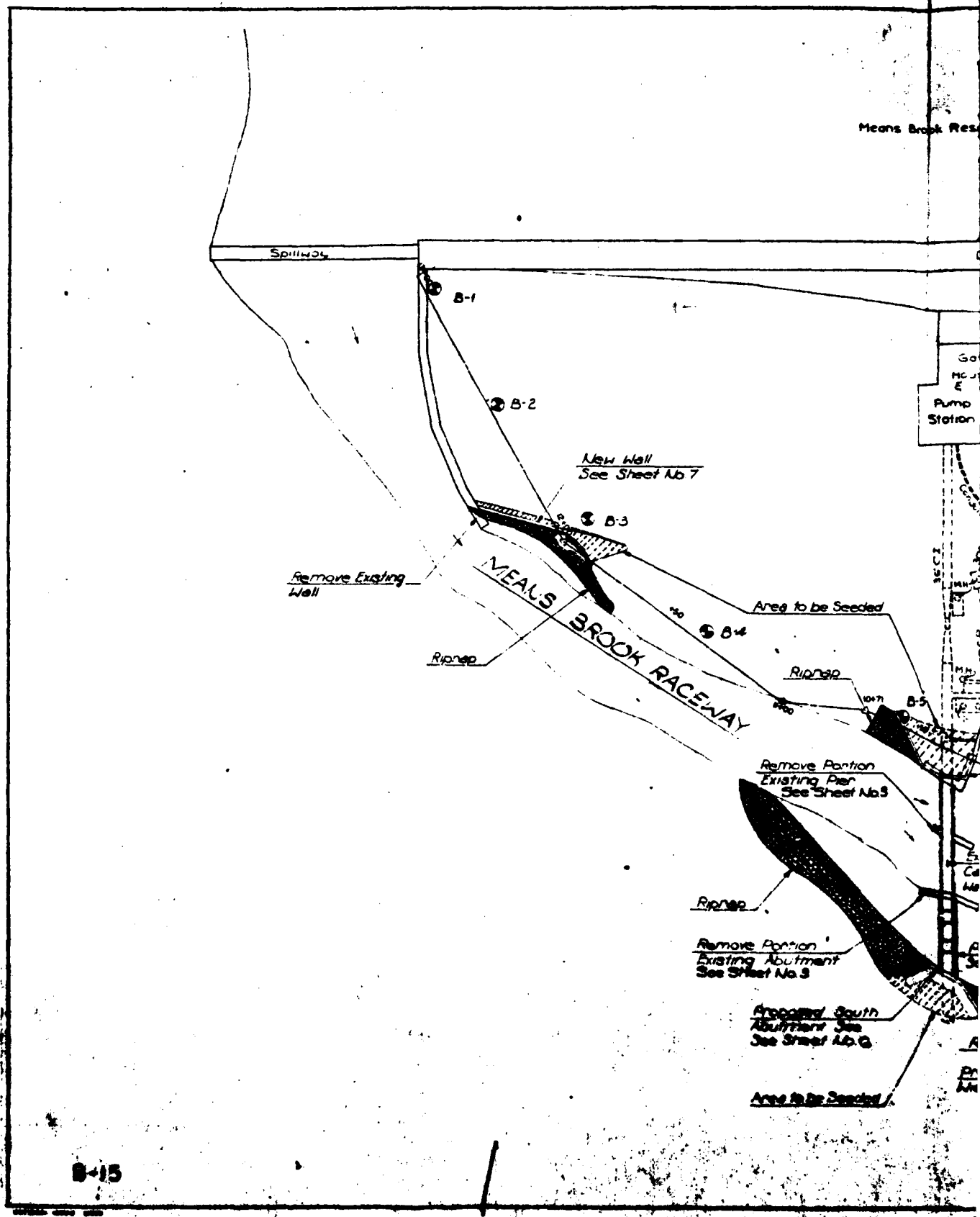
Figures at right indicate numbers of Blows required to drive 1 1/2" o.d. Sampler G using 140 lb hammer dropping 30".

BRIDGEPORT HYDRAULIC COMPANY

MEANS BROOK RAILROAD

LOCATION PLAN AND ELEVATIONS

Sheet Reduced Not to Scale



B-15

Means Brook Reservoir

Dam

Toe of Slope

Bit

SNET
Pole #2210

Anchor
Pole

Gate
House

Pump
Station

CB

SNET
Pole #2220

Bit

High lift
Pump
House

Gravel

Oil Lines

CP

CB

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

CP

(Old) Man
B.H. Co.

Bit

Alter North Abutment
See Sheet No. 5

Existing 36"
Cast Iron
Water Main

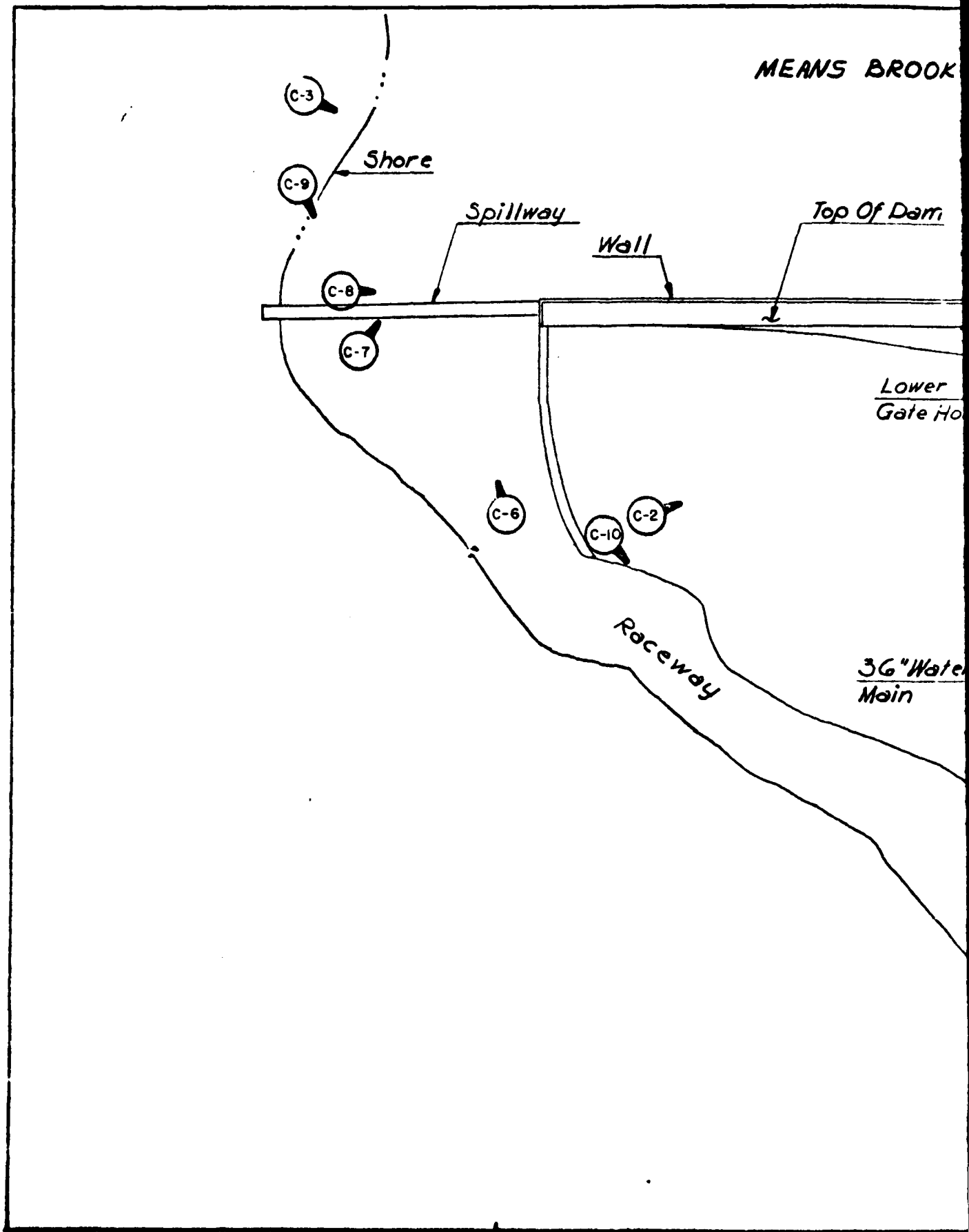
Pipe Bridge
See Sheet No. 5

Riprap

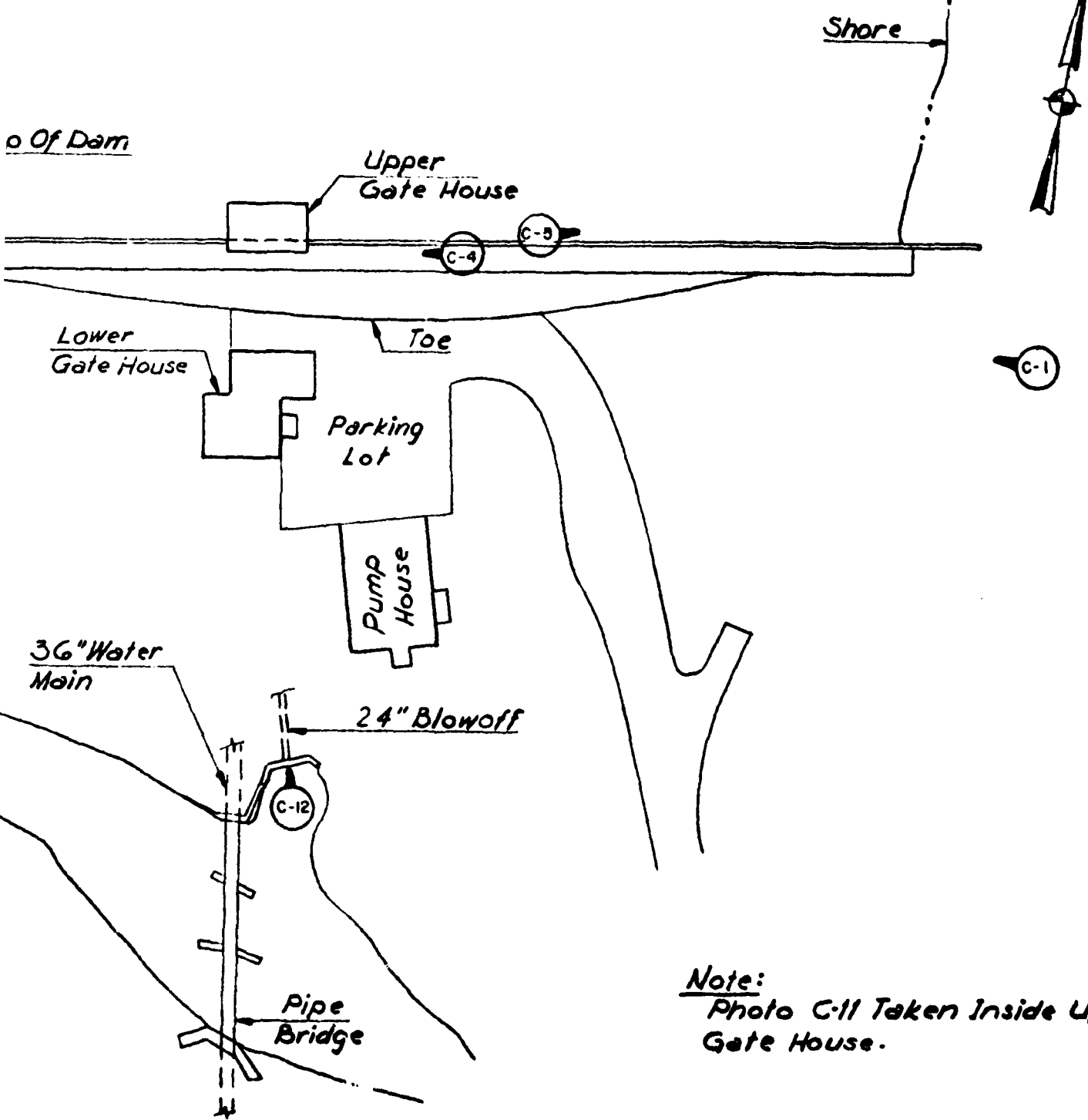
Proposed Channel
widening

BRIDGEPORT HYDRAULIC
COMPANY
MEANS BROOK RACEWAY
SITE PLAN

APPENDIX C
PHOTOGRAPHS



5 BROOK RESERVOIR



Note:
Photo C-11 Taken Inside Upper Gate House.

MEANS BROOK RESERVOIR DAM
PHOTO INDEX



C-1 DOWNSTREAM FACE OF DAM - LOOKING AT WEST
ABUTMENT



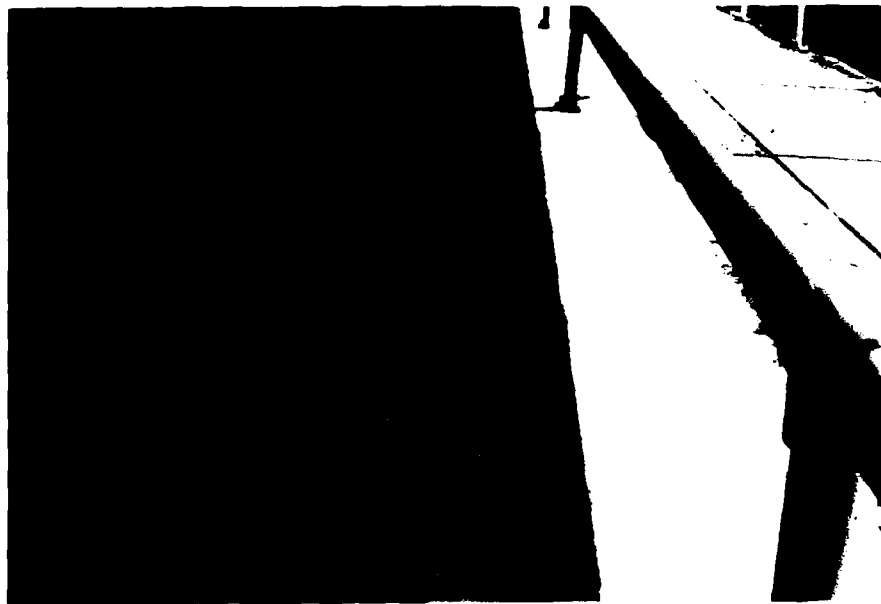
C-2 DOWNSTREAM FACE OF DAM - LOOKING AT EAST
ABUTMENT



C-3 UPSTREAM FACE OF DAM - LOOKING EAST



C-4 TOP OF DAM SHOWING UPPER GATE HOUSE
AND 1977 WALL ADDITION



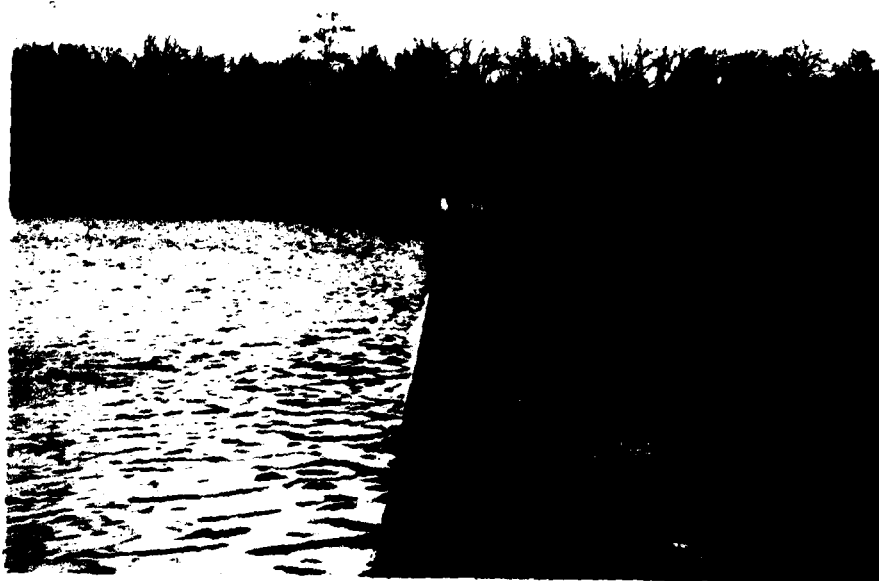
C-5 1977 WALL ADDITION AND EXPOSED REINFORCING
STEEL IN EXISTING TOP OF DAM



C-6 SPILLWAY - LOOKING FROM RACEWAY



C-7 LEAKAGE THROUGH SPILLWAY JOINT



C-8 SPILLWAY - LOOKING EAST



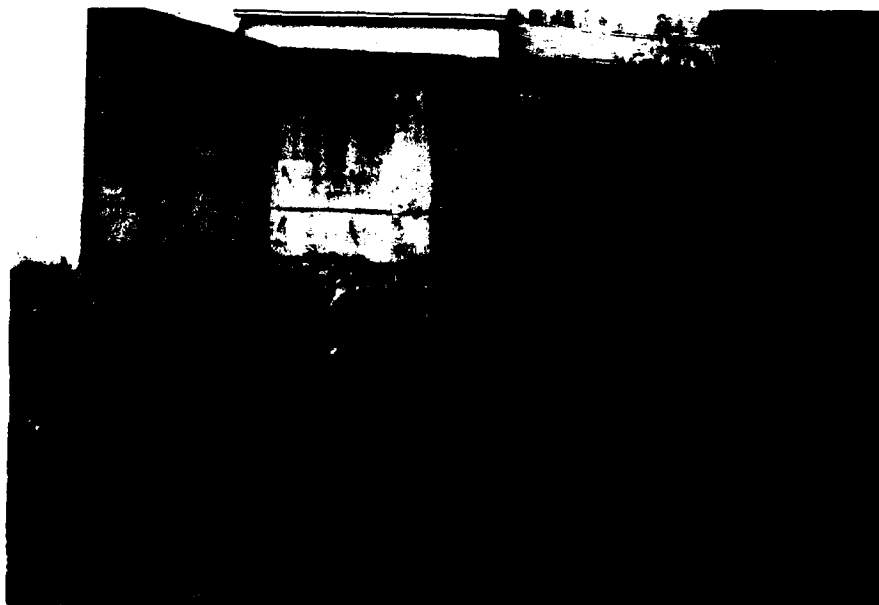
C-9 RACEWAY - LOOKING SOUTH



C-10 RACEWAY AND PIPE BRIDGE FOR 36 INCH
WATER MAIN



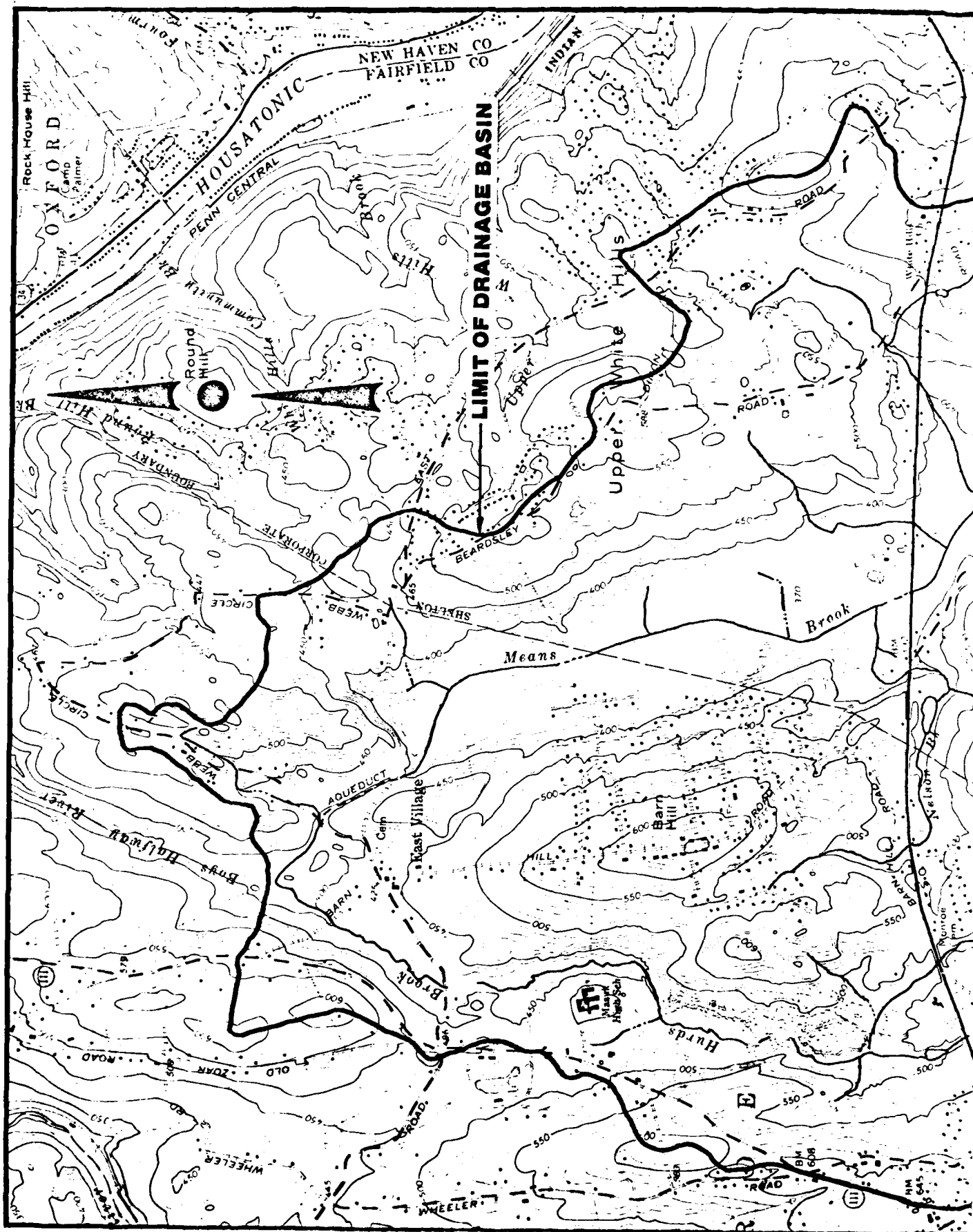
C-11 LIFT MECHANISMS INSIDE
UPPER GATE HOUSE

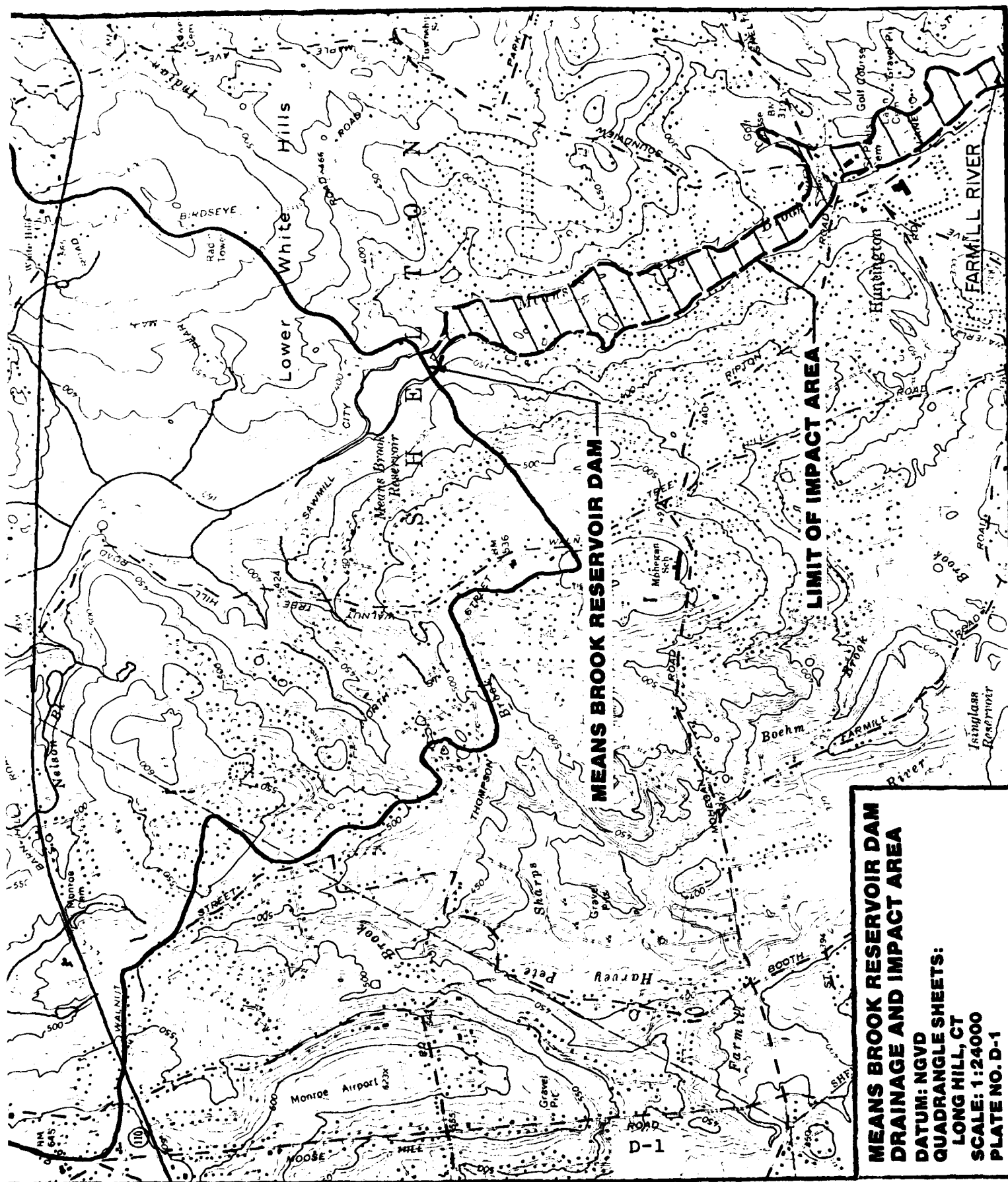


C-12 ENDWALL BELOW DAM SHOWING (FROM LEFT TO RIGHT) 12 INCH
BLOWOFF FROM 36 INCH MAIN, 16 INCH OUTLET FOR 24 INCH BLOW-
OFF, 30 INCH STORM DRAIN, 8 INCH DRAIN FROM PUMP HOUSE.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS





**MEANS BROOK RESERVOIR DAM
DRAINAGE AND IMPACT AREA**

**DATUM: NGVD
QUADRANGLE SHEETS:
LONG HILL, CT
SCALE: 1:24000
PLATE NO. D-1**

**HYDROLOGIC AND HYDRAULIC ANALYSIS
SUMMARY SHEET**

Dam Means Brook Reservoir Dam

Test Flood PMF

INFLOW HYDROGRAPH DEVELOPMENT

Drainage Area 7.65 sq. mi.

Probable Maximum Precipitation
24 hour - 200 square mile PMP 22 inches

Initial Rairfall Loss 0 Inch
Uniform Rairfall loss .1 Inch

Snyder's Lag 5.2 hours
Snyder's Peaking Coefficient .625

Test Flood Inflow 7800 CFS

PMF Inflow 7800 CFS

RESERVOIR ROUTING AND DAM OVERTOPPING

Test Flood Outflow 7800 CFS

Spillway Capacity at Top of Dam 4000 CFS
51 % of Test Flood

Flow Over Spillway at Test Flood 5800 CFS

Spillway Crest Elevation	<u>345.0</u>	Feet
Top of Dam Elevation	<u>350.1</u>	Feet
Test Flood Elevation	<u>351.3</u>	Feet

DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79

```

*****
1  A1 DAM SAFETY ANALYSIS-JOB NO. 79-905/07 ERJ
2  A2 MEANS BROOK RESERVOIR DAM- SHELTON-CONN.
3  A3 1-29-80
4  R 75 1 0 0 0 0 0 0 0 0
5  H1 5 1 2 1 0. 0. 0. 0. 0. 0.
6  J 1 1 1 0. 0. 0. 0. 0. 0.
7  J1 .5 1 1 0. 0. 0. 0. 0. 0.
8  K 0 0 1 0 0 0 0 0 0.
9  K1 COMPUTATION OF PMF- DEVELOPMENT OF INFLOW HYDROGRAPH
10 M 1 1 5.8 0 5.8 0 0 1
11 P 0 22 110 124 133 142 0 1
12 T 0 0 0 0 0 0 0 .1
13 W 5.2 .625
14 K 1.9 .05 2.0 0 0 0 0 1
15 K 1 1 0 0 0 0 0 1
16 K1 ROUTING INFLOW HYDROGRAPH THRU LAKE - OVERTOPPING ANALYSIS
17 Y 0 0 0 1 1 0 0 0
18 Y1 1 0 0 0 0 0 0 -1
19 SA 18.4 21.0 24.0
20 SE 345 347 350.1
21 SS 345.0 100.0 3.5 1.5
22 SD 350.1 2.7 1.5 427
23 K
  
```

4UN DATEO 01/24/80.
TIMEO 14.20.18.

DAM SAFETY ANALYSIS-JOB NO. 79-905/07 ERJ
MEANS BROOK RESERVOIR DAM- SHELTON-CONN.
1-29-60

JOB SPECIFICATION									
NQ	NHR	NMIN	IDAY	INH	IMIN	METRC	IPLT	IPRT	NSTAN
75	1	0	0	0	0	0	2	0	0
			JOPER	NMT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 2 LRTIO= 1

0017-1051

SUB-AREA RUNOFF COMPUTATION

STAGE	INAME	JPT	JPL	IECON	ITAPE	ICOMP	ISTAQ
0	1	0	0	0	0	0	1

HYDROGRAPH DATA									
HYDG	IUMG	TAREA	SNAP	THSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	-	5.80	0.00	5.80	0.00	0.000	0	1	0

PRECIP DATA							
SPFE	PMS	M6	M12	M24	M48	M72	M96
0.00	22.00	110.00	124.00	133.00	142.00	0.00	0.00

TIME SPENT BY THE PROGRAM IS .000

LOSS DATA										
LROPT	STKR	DLTKR	RTIOL	ERAIN	STKRS	RTIOK	STHTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	0.00	.10	0.00	0.00

UNIT HYDROGRAPH DATA
IP= 5.20 CP= .63 NTA= 0

RECESSION DATA

STRTQ=	1.90	QRCSN=	.05	RTIOR=	2.00
--------	------	--------	-----	--------	------

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 6.13 AND R= 4.64 INTERVALS

INIT HYDROGRAPH 28 END-OF-PERIOD ORDINATES, LAG=					5.19 HOURS, CP=	.63	VOL=	1.00
34.	123.	242.	357.	435.	454.	406.	329.	265.
72.	138.	111.	90.	72.	50.	47.	38.	25.
20.	16.	13.	10.	8.	7.	5.	4.	

END-OF-PERIOD FLOW

1.01	4.00	4	.01	0.00	.01	1.	1.02	17.00	41	2.71	2.61	.10	3433.
1.01	5.00	5	.01	0.00	.01	1.	1.02	18.00	42	2.13	2.03	.10	4427.
1.01	6.00	6	.01	0.00	.01	1.	1.02	19.00	43	.16	.06	.10	6837.
1.01	7.00	7	.03	0.00	.03	1.	1.02	20.00	44	.16	.06	.10	7677.
1.01	8.00	8	.03	0.00	.03	1.	1.02	21.00	45	.16	.06	.10	7782.
1.01	9.00	9	.03	0.00	.03	1.	1.02	22.00	46	.16	.06	.10	7161.
1.01	10.00	10	.03	0.00	.03	1.	1.02	23.00	47	.16	.06	.10	6129.
1.01	11.00	11	.03	0.00	.03	1.	1.03	0.00	48	.16	.06	.10	5063.
1.01	12.00	12	.03	0.00	.03	1.	1.03	1.00	49	0.00	0.00	0.00	4122.
1.01	13.00	13	.13	.03	.10	2.	1.03	2.00	50	0.00	0.00	0.00	3355.
1.01	14.00	14	.16	.06	.10	6.	1.03	3.00	51	0.00	0.00	0.00	2729.
1.01	15.00	15	.20	.10	.10	19.	1.03	4.00	52	0.00	0.00	0.00	2215.
1.01	16.00	16	.50	.40	.10	51.	1.03	5.00	53	0.00	0.00	0.00	1793.
1.01	17.00	17	.18	.08	.10	110.	1.03	6.00	54	0.00	0.00	0.00	1447.
1.01	18.00	18	.14	.04	.10	182.	1.03	7.00	55	0.00	0.00	0.00	1165.
1.01	19.00	19	.01	0.00	.01	249.	1.03	8.00	56	0.00	0.00	0.00	939.
1.01	20.00	20	.01	0.00	.01	291.	1.03	9.00	57	0.00	0.00	0.00	756.
1.01	21.00	21	.01	0.00	.01	299.	1.03	10.00	58	0.00	0.00	0.00	609.
1.01	22.00	22	.01	0.00	.01	273.	1.03	11.00	59	0.00	0.00	0.00	489.
1.01	23.00	23	.01	0.00	.01	228.	1.03	12.00	60	0.00	0.00	0.00	393.
1.02	0.00	24	.01	0.00	.01	186.	1.03	13.00	61	0.00	0.00	0.00	316.
1.02	1.00	25	.11	.01	.10	150.	1.03	14.00	62	0.00	0.00	0.00	253.
1.02	2.00	26	.11	.01	.10	121.	1.03	15.00	63	0.00	0.00	0.00	203.
1.02	3.00	27	.11	.01	.10	99.	1.03	16.00	64	0.00	0.00	0.00	162.
1.02	4.00	28	.11	.01	.10	83.	1.03	17.00	65	0.00	0.00	0.00	124.
1.02	5.00	29	.11	.01	.10	70.	1.03	18.00	66	0.00	0.00	0.00	92.
1.02	6.00	30	.11	.01	.10	60.	1.03	19.00	67	0.00	0.00	0.00	65.
1.02	7.00	31	.41	.31	.10	63.	1.03	20.00	68	0.00	0.00	0.00	27.
1.02	8.00	32	.41	.31	.10	94.	1.03	21.00	69	0.00	0.00	0.00	12.
1.02	9.00	33	.41	.31	.10	163.	1.03	22.00	70	0.00	0.00	0.00	3.
1.02	10.00	34	.41	.31	.10	268.	1.03	23.00	71	0.00	0.00	0.00	2.
1.02	11.00	35	.41	.31	.10	398.	1.04	0.00	72	0.00	0.00	0.00	1.
1.02	12.00	36	.41	.31	.10	534.	1.04	1.00	73	0.00	0.00	0.00	1.
1.02	13.00	37	1.94	1.84	.10	707.	1.04	2.00	74	0.00	0.00	0.00	1.
							1.04	3.00	75	0.00	0.00	0.00	0.

SUM 24.99 21.72 3.27 80882.
(635.) (552.) (83.) (2290.32)

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
7782.	6805.	3154.	1123.	80882.
220.	193.	89.	32.	2290.
	10.91	20.24	21.62	21.62
	277.24	513.99	549.15	549.16
	3375.	6256.	6684.	6684.
	4162.	7717.	8245.	8245.

CFS
CMS
INCHES
MM
AC-FT
THOUS CU M

[illegible]

13.00	61.	1
14.00	62.	1
15.00	63.	1
16.00	64.	1
17.00	65.	1
18.00	66.	1
19.00	67.	1
20.00	68.	1
21.00	69.	1
22.00	70.	1
23.00	71.	1
24.00	72.	1
25.00	73.	1
26.00	74.	1
27.00	75.	1

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 2									
	2.	1.	19.	51.	110.	182.	249.	291.	
2.	2.	6.	19.	51.	110.	182.	249.	291.	
273.	228.	186.	150.	121.	99.	83.	70.	60.	
94.	163.	268.	398.	534.	707.	1007.	1523.	2448.	
5427.	6837.	7677.	7782.	7161.	6129.	5063.	4122.	3355.	
2215.	1793.	1447.	1165.	939.	756.	609.	489.	393.	
253.	203.	162.	124.	92.	65.	27.	12.	3.	
1.	1.	1.	0.						
	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL	VOLUME			
6FS	7782.	6805.	3154.	1123.	8082.				
CMS	220.	193.	89.	32.	2290.				
INCHES		10.91	20.24	21.62	21.62				
MM		277.24	513.99	549.15	549.16				
AC-FT		3375.	6256.	6684.	6684.				
THOUS CU M		4162.	7717.	8245.	8245.				

```

*****
HYDROGRAPH ROUTING
ROUTING INFLOW HYDROGRAPH THHU LAKE - OVERTOPPING ANALYSIS
*****
*****
QLOSS      0.0      ISTAQ      1      ICOMP      1      IECON      0      ITAPE      0      JPLT      0      JPRT      0      INAME      1      ISTAGE      0      IAUTO      0
      CLOSS      0.000      AVG      0.00      IRES      1      ROUTING DATA
      0.000      0.00      0.00      ISAME      1      IOPT      0      IMPP      0      LSTH      0
NSTPS      1      NSTDL      0      LAG      0      AMSKK      0      X      0.000      0.000      TSK      0.000      STORA      -1.      ISPRAT      0

```

SURFACE AREA =	18.	21.	24.
CAPACITY =	0.	39.	109.

DAM DATA
TOPEL 350.1
COORD 2.7
EAPIU 1.5
DAMWID 427.

STATION 1. PLAN 1. RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW		STORAGE		STAGE	
0.	0.	0.	0.	0.	0.
0.	1.	0.	0.	1.	1.
146.	127.	106.	87.	28.	99.
32.	57.	99.	71.	59.	41.
1689.	3245.	3755.	230.	311.	654.
1456.	965.	783.	3680.	3205.	2186.
179.	117.	95.	513.	416.	273.
5.	3.	2.	58.	44.	17.
			1.		9.

STAGE		STORAGE		OUTFLOW	
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
10.	10.	10.	7.	6.	4.
4.	4.	6.	11.	14.	29.
58.	76.	93.	103.	102.	80.
52.	45.	39.	29.	21.	19.
12.	10.	9.	7.	4.	2.
1.	1.	1.	0.		

STAGE		STORAGE		OUTFLOW	
345.0	345.0	345.0	345.0	345.0	345.0
345.0	345.0	345.0	345.1	345.3	345.4
345.6	345.6	345.5	345.4	345.3	345.2
345.2	345.2	345.3	345.6	345.9	346.2
347.9	348.7	349.4	350.0	349.8	348.4
347.6	347.3	347.0	346.5	346.1	346.0
345.6	345.6	345.5	345.4	345.3	345.8
345.1	345.0	345.0	345.3	345.2	345.1

PEAK OUTFLOW IS 3902. AT TIME 45.00 HOURS

CFS		INCHES		MM		AC-FT		THOUS CU M	
PEAK	3902.	6-HOUR	3395.	24-HOUR	1577.	72-HOUR	562.	TOTAL	VOLUME
	110.		96.		45.		16.		40437.
			5.44		10.12		10.81		1145.
			138.29		256.94		274.55		10.81
			1683.		3120.		3342.		274.55
			2076.		3858.		4122.		3342.
									4122.

INFLUX(I), OUTFLOW(O) AND OBSERVED FLOW(*)										
0.	500.	1000.	1500.	2000.	2500.	3000.	3500.	4000.	0.	0.
1.00										
2.00										
3.00										
4.00										
5.00										
6.00										
7.00										
8.00										
9.00										
10.00										
11.00										
12.00										
13.00										
14.00										
15.00										
16.00										
17.00										
18.00										
19.00										
20.00										
21.00										
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23.00										
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15.00 63.1
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23.00 71.1
24.00 72.1
25.00 73.1
26.00 74.1
27.00 75.1

STATION 1. PLAN 1. RATIO 2
END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW		STORAGE	
0.	1.	0.	0.
1.	2.	1.	3.
296.	208.	12.	10.
63.	210.	13.	9.
345.	7609.	143.	29.
2000.	1546.	140.	132.
349.	184.	47.	34.
8.	3.	10.	7.
		1.	5.
		1.	4.
		1.	2.
		1.	0.
		1.	16.
		1.	6.
		1.	69.
		1.	99.
		1.	22.
		1.	2.

OUTFLOW		STORAGE	
0.	1.	0.	0.
1.	2.	1.	3.
296.	208.	12.	10.
63.	210.	13.	9.
345.	7609.	143.	29.
2000.	1546.	140.	132.
349.	184.	47.	34.
8.	3.	10.	7.
		1.	5.
		1.	4.
		1.	2.
		1.	0.
		1.	16.
		1.	6.
		1.	69.
		1.	99.
		1.	22.
		1.	2.

STAGE		STAGE	
345.0	345.0	345.0	345.0
345.0	345.0	345.1	345.3
345.9	345.8	345.6	345.5
345.3	345.4	345.7	346.5
349.6	350.7	351.5	351.0
349.1	348.6	347.7	347.0
346.0	345.9	345.7	345.5
345.1	345.1	345.0	345.4
			345.2
			345.1
			345.0
			345.7
			345.4
			345.3
			346.2
			349.7
			345.1

PEAK OUTFLOW IS 7012. AT TIME 45.00 HOURS

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
7012.	6806.	3154.	1123.	80877.
221.	193.	89.	32.	2290.
	10.92	20.23	21.62	
	277.24	513.94	549.12	
	3375.	6256.	6684.	
	4163.	7716.	8245.	

	1000.	2000.	3000.	4000.	5000.	6000.	7000.	8000.	0.	0.	0.	0.	0.	0.
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54.00														
55.00														
56.00														
57.00														

15.00	63.1
16.00	64.1
17.00	65.1
18.00	66.1
19.00	67.1
20.00	68.0
21.00	69.1
22.00	70.1
23.00	71.1
0.00	72.1
1.00	73.1
2.00	74.1
3.00	75.1

PEAK FLOW AND STORAGE (FND OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

RATIOS APPLIED TO FLOWS

OPERATION	STATION	AREA	PLAN	RATIO 1	RATIO 2
				.50	1.00
HYDROGRAPH AT	1	5.80	1	3891.	7782.
	(15.02)	(110.19)	(220.38)
ROUTED TO	1	5.80	1	3902.	7812.
	(15.02)	(110.49)	(221.22)

PLAN 1

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	349.99	0.00	106.	3902.	0.00	45.00	0.00
1.00	351.53	1.43	144.	7812.	8.00	45.00	0.00

INITIAL VALUE
345.00
0.
0.

ELEVATION
STORAGE
OUTFLOW

SPILLWAY CHEST
345.00
0.
0.

TOP OF DAM
350.10
100.
4031.

MEANS BROOK RESERVOIR DAM

A. Size Classification

Height of dam = 50 ft.; hence intermediate

Storage capacity at top of wall (elev. 350.1) = 373 AC-FT.; hence small

Adopted size classification intermediate

B.i) Hazard Potential

Failure would result in the loss of more than a few lives,
many homes and damage to the village of Huntington.

ii) Impact of Failure of Dam at Normal Pool (Spillway crest)

It is estimated from the rule of "thumb" failure hydrograph, that the following adverse impacts are a possibility by the failure of this dam.

- a) Loss of homes 25-30 ;
- b) Loss of buildings 6+ ;
- c) Loss of highways or roads 2-3 ;
- d) Loss of bridges 1-2 ;

The failure profile can affect a distance of 11500 feet from the dam.

C. Hazard Potential Classifications

<u>HAZARD</u>	<u>SIZE</u>	<u>TEST FLOOD RANGE</u>
<u>High</u>	<u>Intermediate</u>	<u>PMF</u>
Adopted Test Flood = <u>PMF</u> = <u>1020</u> CSM		
= <u>7800</u> CFS		

D. Overtopping Potential

Drainage Area 3519 acres = 7.65 sq. miles

Spillway crest elevation = 345.0 NGVD

Top of Dam Elevation = 348.0 (350.1 - top of wall) NGVD

Maximum spillway discharge

Capacity without overtopping of dam = 4000 CFS
 "test flood" inflow discharge = 7800 CFS
 "test flood" outflow discharge = 7800 CFS

MEANS BROOK RESERVOIR DAM

Dam Failure Analysis

1. Failure discharge with pool at spillway (elev. 345.0) = 19600 CFS
2. Depth of water in reservoir at time of failure = 30 ft.
3. Maximum depth of flow downstream of dam = 16 ft.
4. Water surface elevation just downstream) 316
of dam at time of failure) = NGVD

The failure discharge of 19600 CFS will enter and flow downstream 11500 feet until the brook enters the Farhill River.

Valley storage in this 11500 feet length of brook is substantial in reducing the discharge. Also due to roughness characteristics, obstructions and frictional losses, it is very likely that the unsteady dam failure flow will dissipate its wave and kinetic energy and thus convert to steady and uniform flow obeying Manning's formulae 11500 feet downstream. The failure profile will have the following hydraulic characteristics:

DISTANCE FROM THE DAM	WATER SURFACE ELEVATION NGVD	REMARKS
0	345.0	Upstream of dam
100	316.0	
1000	304.6	
4000	302.2	
8000	252.0	
10500	232.0	Huntington
11500	232.0	Farhill River

Beyond 11500 feet,
failure discharge will flow in the below given channel characteristics:

Q = 4700 CFS; S = .005
n = .05; b = 20; d = 2

Side slopes = 1V on 5H.

"Rule of Thumb Guidance for Estimating
Downstream Dam Failure Analysis"

DATA

Name of Dam Means Brook Reservoir Dam
Location Town of Shelton
Drainage Area 7.65 sq. mi., Top of Dam 348.0 NGVD
Spillway Type Overflow - ogee, Crest of Spillway 345.0 NGVD
Surface Area @ Crest Elev. 24 Acres = .04 sq. mi.
Pool Bottom Near Dam = 315 NGVD*
Assumed Side Slopes of Embankments = 2:1
Depth of Pool at Dam (Yo) = 30 Feet*
Mid-Height Elev. 332 NGVD
Length of Dam at Crest = 430 Feet
Length of Dam at Mid-Height = 285 Feet
25% of Dam Length at Mid-Height = W_b = 71 Feet

Step 1

Storage (S) at time of failure 268 Ac-FT
(Equal to spillway crest)

Step 2

Peak Failure Discharge
 $Q_{pl} = 8/27 W_b \sqrt{g} Y_o^{3/2}$
 $= 1.68 W_b Y_o^{3/2} = 19600$ cfs

Failure is assumed to coincide with pool elevation at top of dam.

* Referring to toe of dam on the downstream face.

The Farhill River is located 11500 feet downstream of Means Brook Reservoir dam. There is a 70 foot drop into the Farhill River which will cause the dissipation of wave and kinetic energy of the failure discharge. Approximately, the water surface elevations between the Means Brook Reservoir dam and the Farhill River will be as given on Dam Failure Analysis. The increase of depth in the Farhill River due to failure of Means Brook Res. dam is estimated to be 2 feet.

BY: ED DATE: 1/27/79 SUBJECT: DAM INSPECTION
 CHKD. BY: EDA DATE: 1-27-80 STUDIES

SHEET NO. 1 OF 5
 JOB NO. 79-905/07

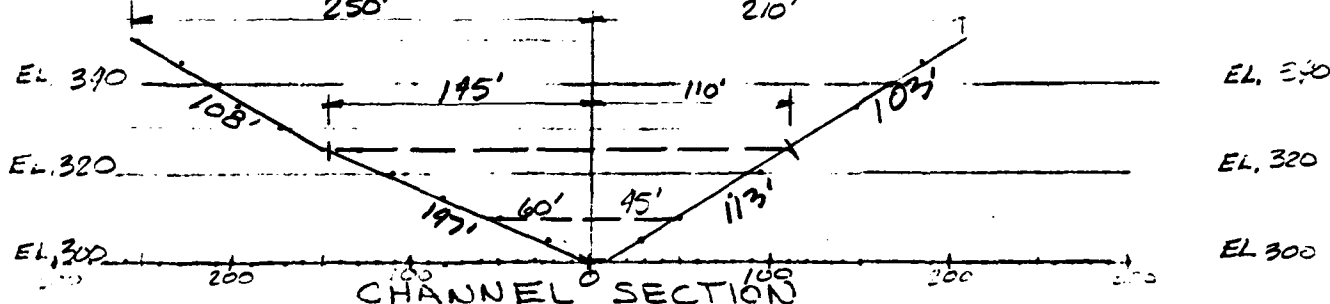
DOWNSTREAM W.S. EL. COMPUTATIONS

NAME OF DAM: Mesa Vista Power

SECTION LOCATION: 100' DOWNSTREAM OF DAM

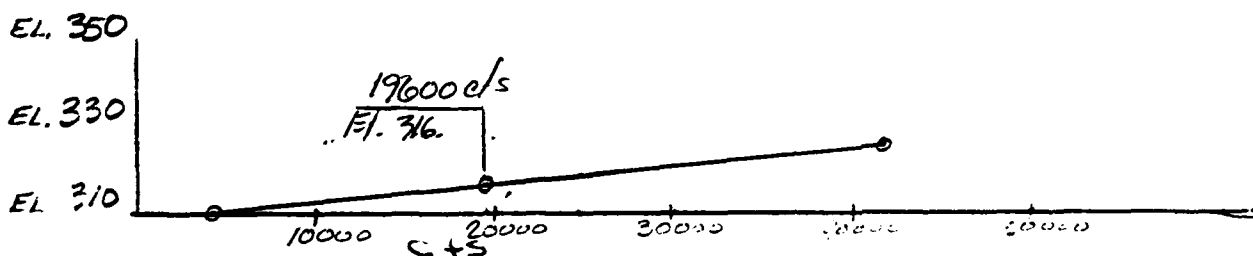
USING: $Q = 1.486/n A R^{2/3} S^{1/2}$

WHERE: $n = 0.05$ $S = \text{SLOPE} = .0067'/ft$



$Q_F = 19600$ cfs STORAGE (S) 268 AC-FT

ELEV'	AREA	VIP	R	$R^{2/3}$	$S^{1/2}$	$1.486/n$	Q	DEPTH
325	3313	270'	12.3	5.33	.08	29.72	4193	25'
350	1225	481	25.5	8.67	.03	29.72	2525	50'
310	575	105	5.48	3.11	.03	29.72	4252	10'



$T_1 = \left(\frac{1}{2} \times 43,560 \right)^{1/2} =$ AC-FT

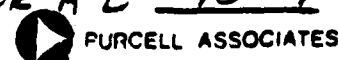
$Q_{P2} = Q_{P1} (1 - V_1/S) =$ cfs

$V_2 =$ AC-FT $V_{AVE} =$ AC-FT

$Q_{P2} = Q_{P1} (1 - V_{AVE}/S) =$ cfs

D-21

STAGE DISCHARGE = 19600 cfs ELEV = 316 OR A D 16 T
 NEXT DOWNSTREAM SECTION 1000 FT.



BY: FCB DATE: 1/27/79 SUBJECT: DAM INSPECTION
 CHKD. BY: RDA DATE: 1-21-80 STUDIES

SHEET NO. 2 OF 5
 JOB NO. 79-905/07

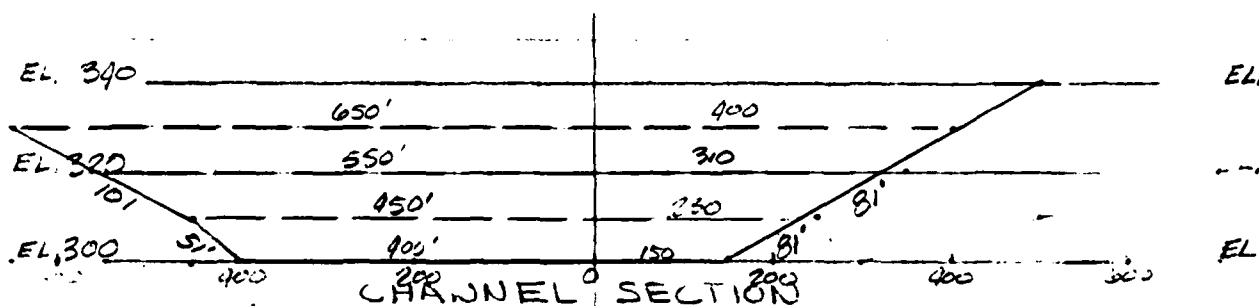
DOWNSTREAM W.S. EL. COMPUTATIONS

NAME OF DAM: Med. Kier Reservoir

SECTION LOCATION: 1000' DOWNSTREAM OF DAM

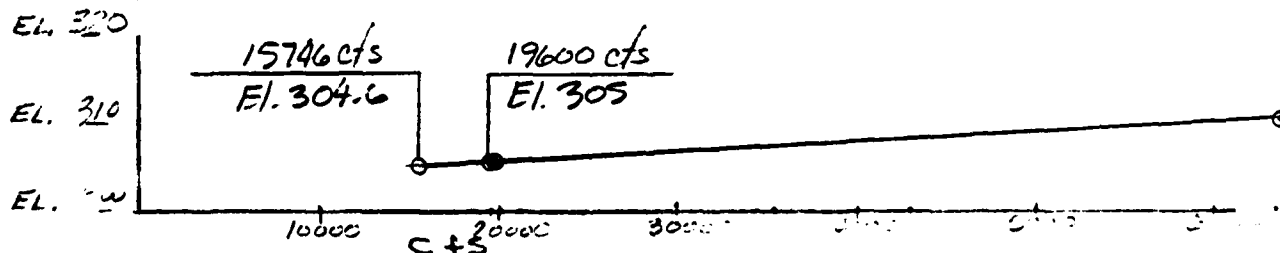
USING: $Q = 1.486/n A R^{2/3} S^{1/2}$

WHERE: $n = 0.05$ $S = \text{SLOPE} = .0067/ft$



$Q_F = 19600$ cfs STORAGE (S) 268 AC-FT

ELEV	AREA	WP	R	$R^{2/3}$	$S^{1/2}$	$1.486/n$	Q	DEPTH
310	6150	682	9.02	4.33	.03	29.72	63314	10'
320	13850	864	16.03	6.36	.03	29.72	209433	20'
305	2912	616	4.73	2.32	.03	29.72	19524	5'



$V_1 = \frac{10450}{2} \times \left(\frac{175600}{2} \times 1000 \div 43,560 \right)^{1/2} = 52.2$ AC-FT

$Q_{P2} = Q_{P1} (1 - V_1^{1/3}) = 15746$ cfs

$V_2 = \frac{10450}{2} \times 8.90 \times 1/2 = 51.8$ AC-FT $V_{AVG} = 52.3$ FT

$Q_{P2} = Q_{P1} (1 - V_{AVG}^{1/3}) = 15779$ cfs

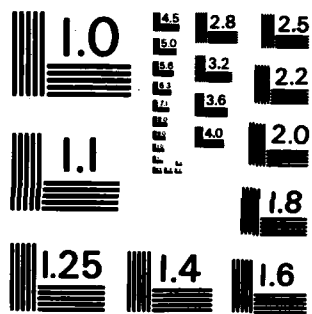
STAGE DISCHARGE: 15779 cfs ELEV = 304.6 OR A D = 4.6 FT

D-22

NEXT DOWNSTREAM SECTION 3000 FT.



PURCELL ASSOCIATES



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

BY: FLB DATE: 1/22/79 SUBJECT: DAM INSPECTION
 CHKD. BY: RDA DATE: 1-21-80 STUDIES

SHEET NO. 3 OF 5
 JOB NO. 79-905/07

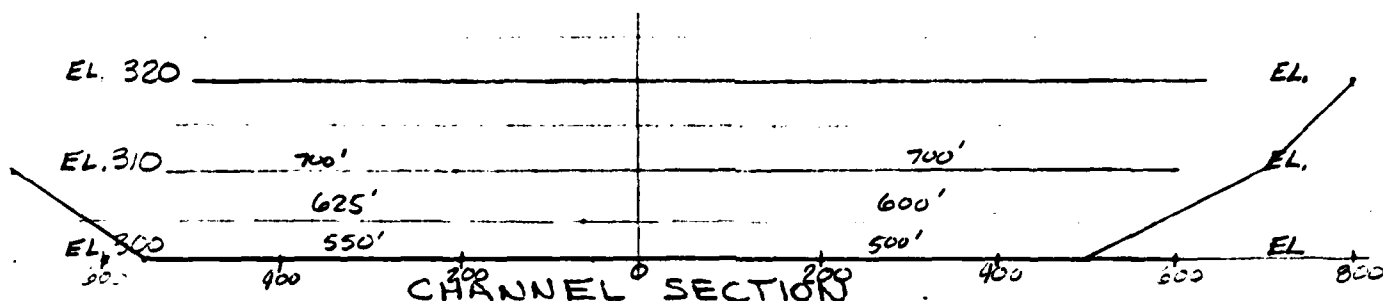
DOWNSTREAM W.S. EL. COMPUTATIONS

NAME OF DAM: Means Brook Reservoir

SECTION LOCATION: 4000' DOWNSTREAM OF DAM

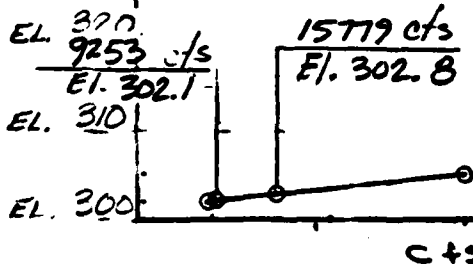
USING: $Q = 1.486/n A R^{2/3} S^{1/2}$

WHERE: $n = 0.05$ $S = \text{SLOPE} = .0067'/ft$



$Q_P = 15779$ cfs STORAGE (S): 268 AC-FT

ELEV	AREA	WP	R	$R^{2/3}$	$S^{1/2}$	$1.486/n$	Q	DEPTH
305	5633	1275	4.46	2.71	.08	29.72	36649	5'
310	12250	1400	8.75	4.25	.08	29.72	123784	10'
302	2150	1100	1.95	1.56	.08	29.72	7974	2'



$V_1 = \frac{4.6 + 2.8}{2} \times \left(\frac{600 + 1140}{2} \times 3000 \div 43,560 \right)^{1/2} = 111$ AC-FT

$Q_{P2} = Q_{P1} (1 - V_1/3) = 9253$ cfs

$V_2 = \frac{4.6 + 2.1}{2} \times \left(\frac{600 + 1120}{2} \times 3000 \div 43,560 \right)^{1/2} = 99$ AC-FT $V_{AVG} = 105$ AC-FT

$Q_{P2} = Q_{P1} (1 - V_{AVG}/3) = 9591$ cfs

STAGE DISCHARGE 9591 cfs ELEV: 302.2 OR A E 2.2 FT



BY: FLG DATE: 1/22/79 SUBJECT: DAM INSPECTION
 CHKD. BY: BCA DATE: 1-21-80 STUDIES

SHEET NO. 4 OF 5
 JOB NO. 19-905/07

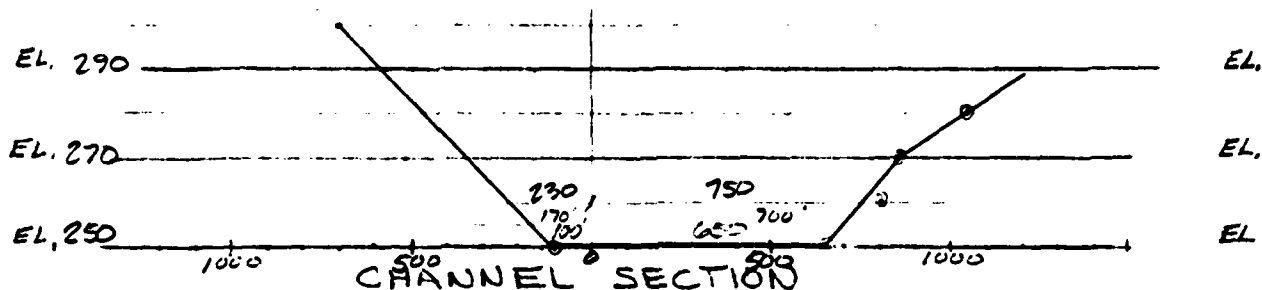
DOWNSTREAM W.S. EL. COMPUTATIONS

NAME OF DAM: Meadow Pool Reservoir

SECTION LOCATION: 8000' DOWNSTREAM OF DAM

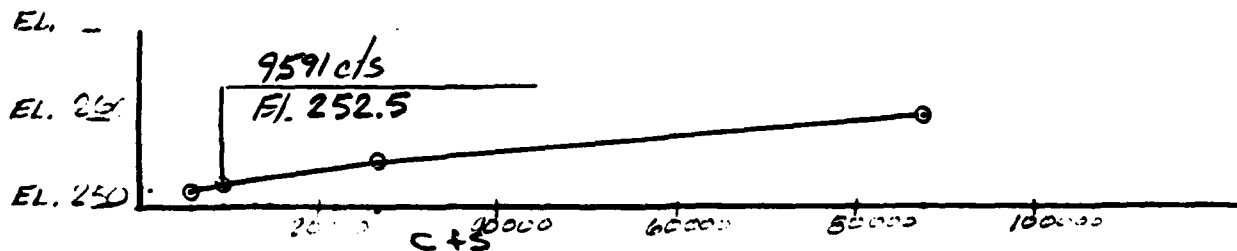
USING: $Q = 1.486/n A R^{2/3} S^{1/2}$

WHERE: $n = 0.05$ $S = \text{SLOPE} = .0067'/ft$



$Q_F = 9591$ cfs STORAGE (S) 268 AC-FT

ELEV	AREA	WP	R	$R^{2/3}$	$S^{1/2}$	$1.486/n$	Q	DEPTH
255	4050	870	4.66	2.79	.03	29.72	26300	5'
260	8650	930	8.33	4.27	.03	29.72	37913	10'
252	1560	810	1.93	1.55	.03	29.72	5719	2'



$V_1 = \frac{2.2+2.5}{2} \times \left(\frac{1120+900}{2} \times 4000 \div 43,560 \right)^{1/2} = 109$ AC-FT

$Q_{P2} = Q_{P1} (1 - V_1/3) = 5691$ cfs, EL. 252

$V_2 = \frac{2.6+3.0}{2} \times 92.75 \times 1/2 = 107$ AC-FT $V_{AVE} = 108$ - FT

$Q_{P2} = Q_{P1} (1 - V_{AVE}/3) = 5732$ cfs

STAGE DISCHARGE = 5732 cfs ELEV = 252.0 OR A E = 2.0 FT

BY: F.C.B. DATE: 1/27/79 SUBJECT: DAM INSPECTION
 CHKD. BY: BDA DATE: 1-21-80 STUDIES

SHEET NO. 5 OF 5
 JOB NO. 79-905/07

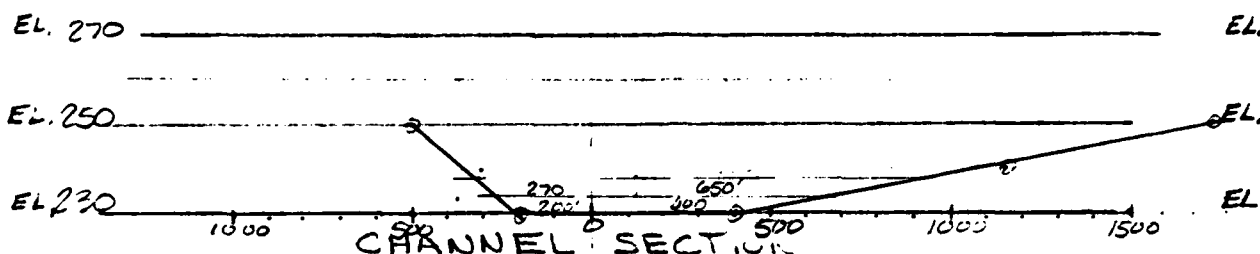
DOWNSTREAM W.S. EL. COMPUTATIONS

NAME OF DAM: Merrill Brook Dam

SECTION LOCATION: 10500' DOWNSTREAM OF DAM

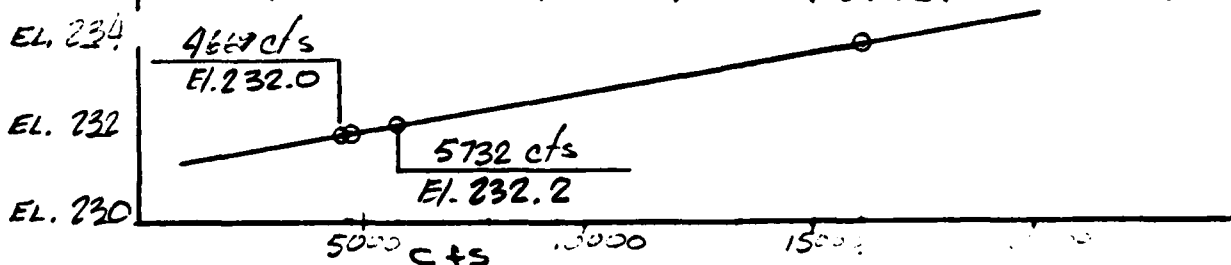
USING: $Q = 1.486/n A R^{2/3} S^{1/2}$

WHERE: $n = 0.05$ $S = \text{SLOPE} = .0067'/ft$



$Q_P = 5732$ cfs STORAGE (S) 268 AC-FT

ELEV.	AREA	WP	R	$R^{2/3}$	$S^{1/2}$	$1.486/n$	Q	DEPTH
232	1360	760	1.79	1.47	.08	29.72	4753	2
234	3040	920	3.30	2.22	.09	29.72	16046	4
						29.72		



$$V_1 = \frac{2.0 + 2.2}{2} \times \left(\frac{900 + 150}{2} \times 2500 \div 43,560 \right)^{1/2} = 49.7 \text{ AC-FT}$$

$$Q_{P2} = Q_{P1} (1 - V_1/3) = 4669 \text{ cfs}$$

$$V_2 = 2.0 \times 47.3 \times 1/2 = 47.3 \text{ AC-FT } V_{A1} = 40.5 \text{ AC-FT}$$

$$Q_{P2} = Q_{P1} (1 - V_{A1}/3) = 4695 \text{ cfs}$$

STAGE DISCHARGE = 4695 cfs ELEV = 232.0 OR A D 2.0 IT

NEXT DOWNSTREAM SECTION 1000 FT.

CONFLUENCE W/ FAIRHILL RIVER

RATING CURVE DEVELOPMENT

Means Brook Reservoir Dam

Spillway

$$Q = C L H^{3/2}$$

$$C = 3.5$$

$$L = 100 \text{ feet}$$

30 Inch Pipe

$$Q = c a (2gh)^{1/2}$$

$$c = .6$$

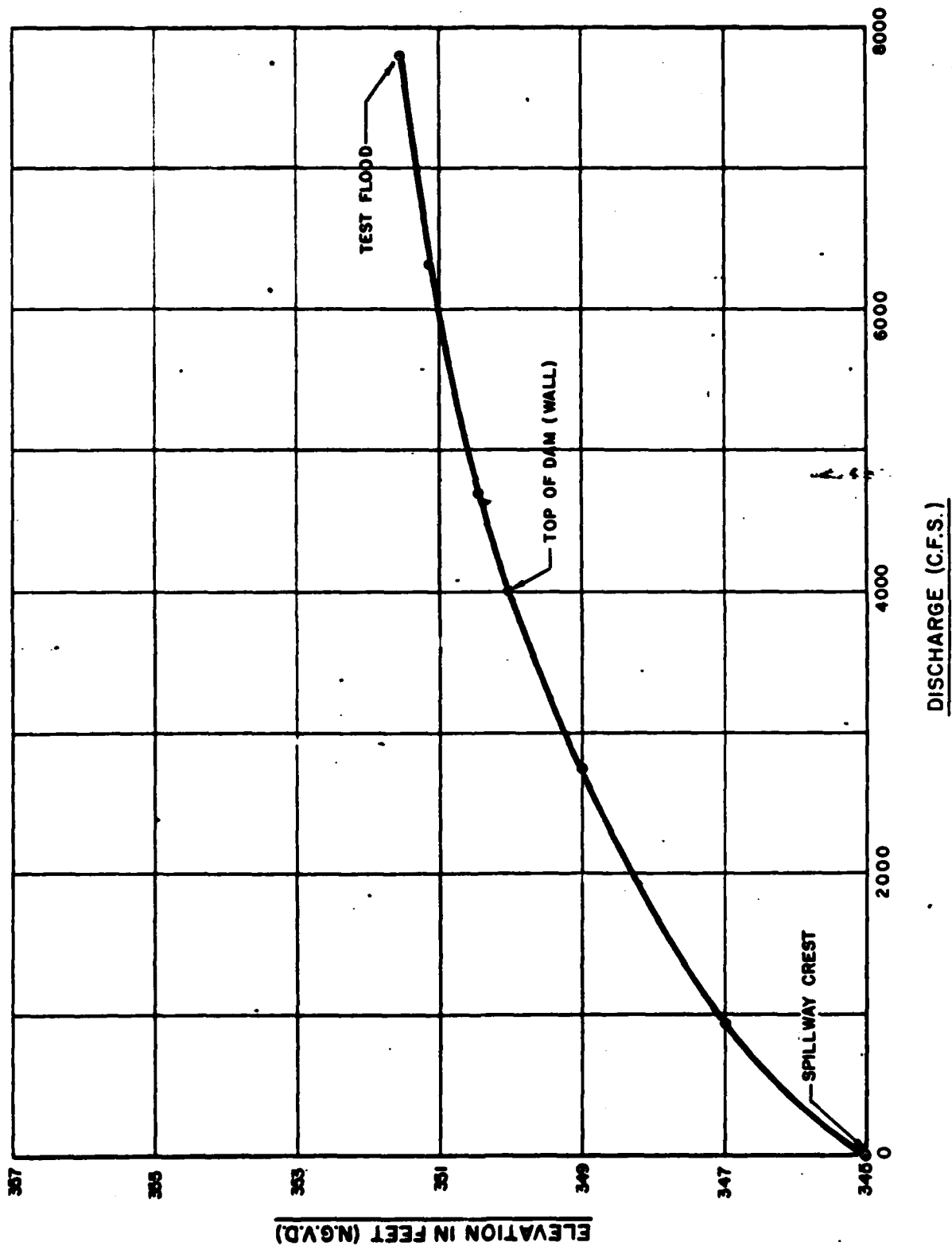
$$a = 4.9 \text{ square feet}$$

24 Inch Blowoff

$$Q = c a (2gh)^{1/2}$$

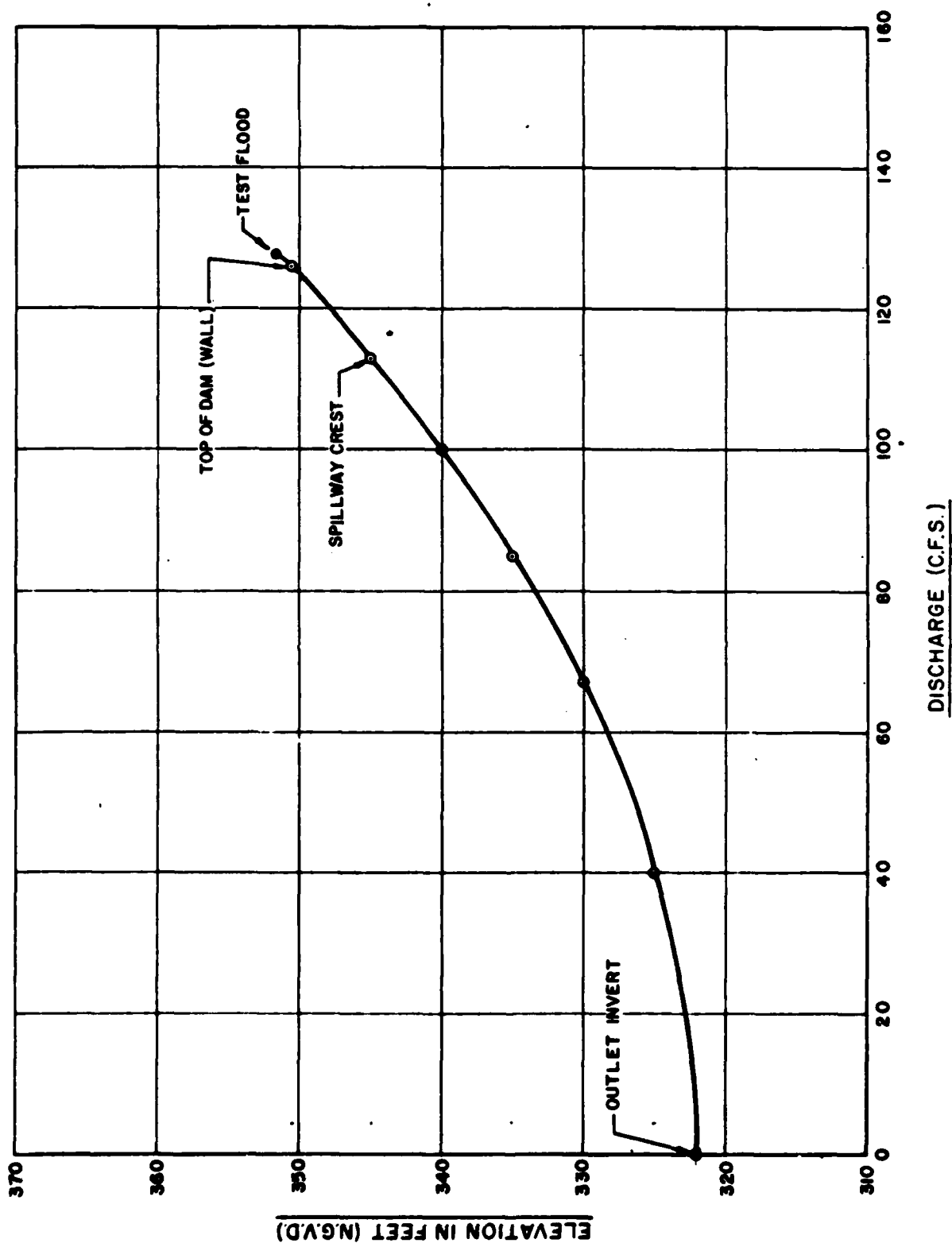
$$c = .6$$

$$a = 1.4 \text{ square feet (16 inch pipe at outlet)}$$

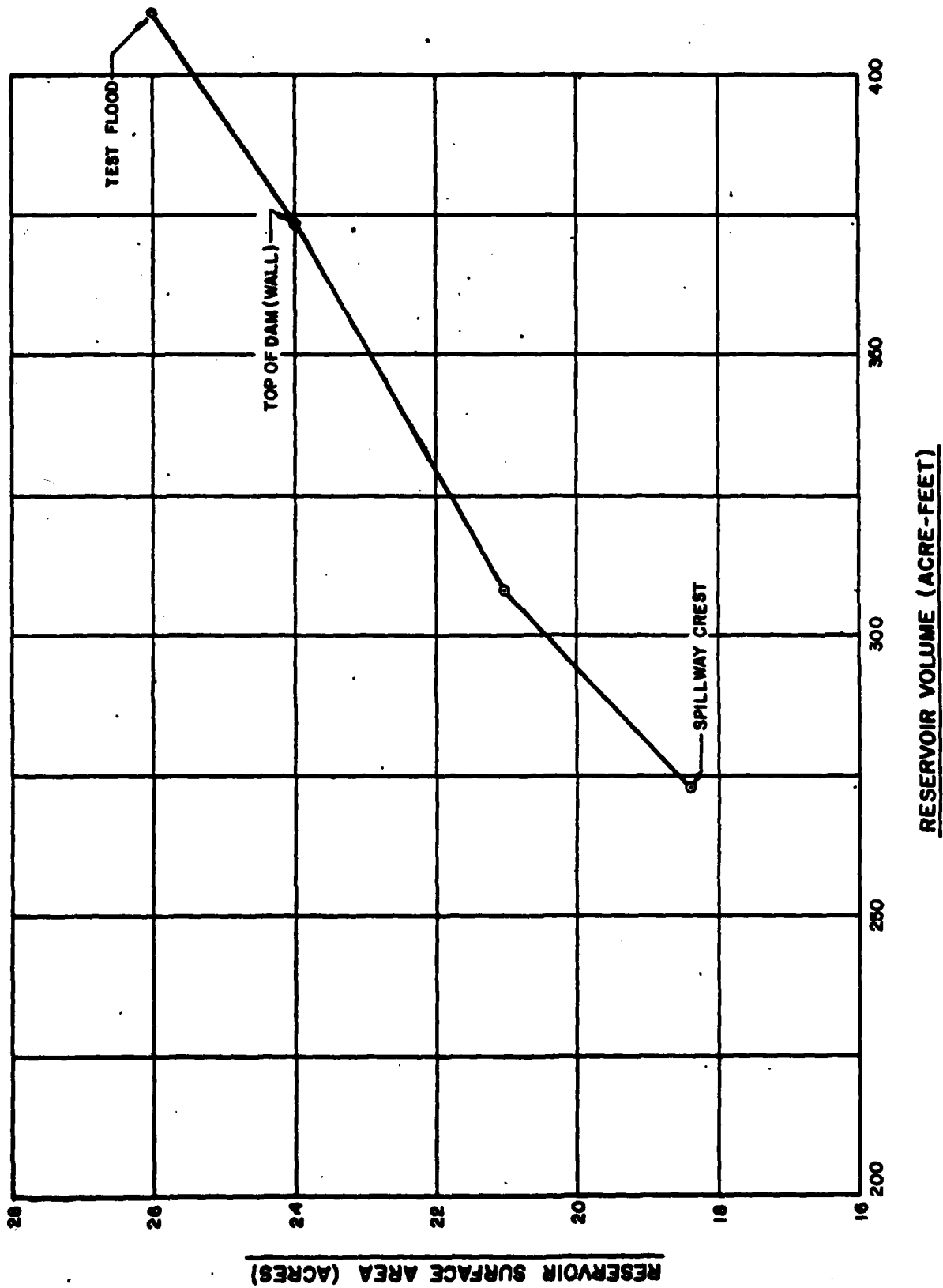


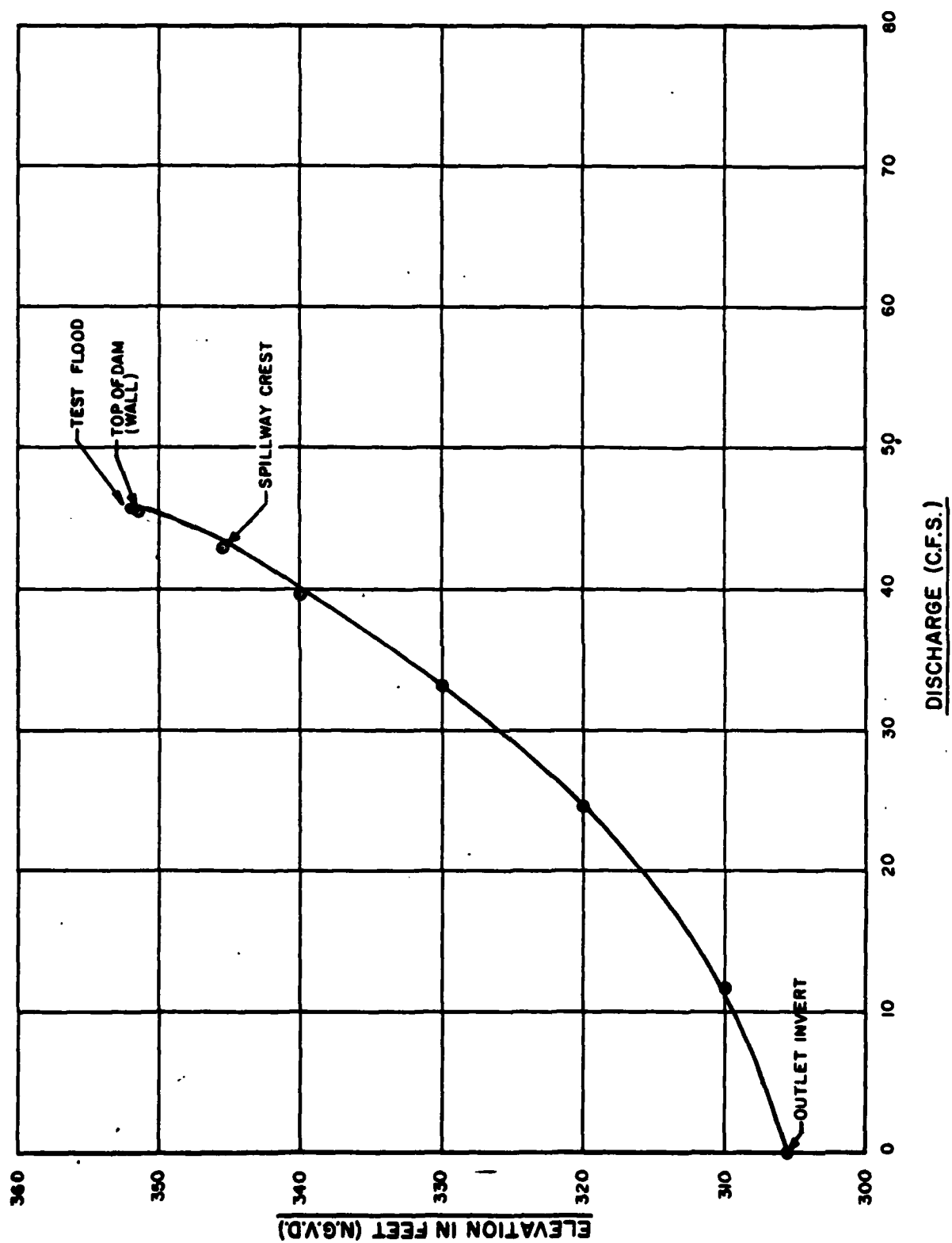
D-27

MEANS BROOK RESERVIOR DAM
SPILLWAY RATING CURVE



MEANS BROOK RESERVOIR DAM
30 INCH SERVICE MAIN
OUTLET WORKS RATING CURVE





MEANS BROOK RESERVOIR DAM
24 INCH BLOWOFF
D-30 OUTLET WORKS RATING CURVE

APPENDIX E
INFORMATION AS CONTAINED IN THE
NATIONAL INVENTORY OF DAMS

NOT AVAILABLE AT THIS TIME

EN

DATE

FILME

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8